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Soviet Military Capabilities and Intentions in Space

National Intelligence Estimate

CIA HISTORICAL REVIEW PROGRAM
RELEASE AS SANITIZED

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NIE 11-1-80

SOVIET MILITARY CAPABILITIES AND INTENTIONS IN SPACE

Information available as of 6 August 1980 was used in the preparation of this Estimate.

THIS ESTIMATE IS ISSUED BY THE DIRECTOR OF CENTRAL INTELLIGENCE.

THE NATIONAL FOREIGN INTELLIGENCE BOARD CONCURS, EXCEPT AS NOTED IN THE TEXT.

The following intelligence organizations participated in the preparation of the Estimate:

The Central Intelligence Agency, the Department of State, the Defense Intelligence Agency, and the National Security Agency.

Also Participating:

The Assistant Chief of Staff for Intelligence, Department of the Army

The Director of Naval Intelligence, Department of the Navy

The Assistant Chief of Staff, Intelligence, Department of the Air Force

SCOPE NOTE

This National Intelligence Estimate assesses present and future Soviet military capabilities and intentions in space. Soviet civil space systems are addressed only insofar as they clarify the scope and magnitude of the military program. Comparisons with US space systems are made where they can serve as useful benchmarks for understanding Soviet capabilities or philosophy. The comparisons should not be interpreted as technical assessments showing superiority or inferiority of Soviet systems relative to US systems.

The Estimate treats the following elements of the Soviet military space program:

— Scope, magnitude, organization, and management.

— Technical capabilities and limitations of current Soviet space systems and prospects for new systems, as evidenced by current research, development, and testing activities, by trends in the Soviet program, and by our perceptions of Soviet requirements.

— Operational capabilities of current and prospective Soviet space systems to serve known and potential military support functions, and the USSR's dependence on its space systems.

— Current and prospective Soviet spaceborne antisatellite systems and prospects for their use.

The assessments and projections in this Estimate have been limited, for the most part, to a period covering the next 10 years. The cutoff date for information used in the report was June 1980.

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EXECUTIVE SUMMARY

1. Over the past 23 years, the Soviet space program has evolved from one emphasizing civil space accomplishments for prestige purposes to one emphasizing the use of space systems for military support. Today 70 percent of Soviet space systems serve only a military support mission, and another 15 percent serve both military and civil purposes. The Soviets conduct about 100 space launches annually and at any one time have 70 to 110 operational satellites in orbit. In support of their space program, the Soviets are developing new space launch vehicles (SLVs), building new launch sites and modifying some older ones, upgrading their land-based command, control, and tracking sites, and upgrading ships dedicated to supporting space activities.

2. Developments in the Soviet military space program tend to be evolutionary in nature. As with many other military programs, the Soviets continue to operate older satellite systems long after the introduction of improved systems. Improved payloads are often incorporated into proven spacecraft. Some completely new, technically complex systems (launch detection satellites, for example, and radar and ELINT ocean reconnaissance satellites) have suffered many problems during the flight test phase.

3. The Soviets have placed more emphasis than the United States on development of space systems directly responsive to military requirements. Both countries have developed satellite systems for photoreconnaissance, ELINT reconnaissance, communications, detection of ballistic missile launches, navigation, geodesy, and meteorology. In addition, the Soviets have developed military space systems for which there are no comparable US systems. They have radar and ELINT ocean reconnaissance systems that can provide targeting data in real time to selected naval combatants carrying antiship weapons. They have developed manned space stations for the purposes of reconnaissance and military-related research. They also have an operational orbital interceptor for destruction of satellites in near-Earth orbits.

4. Although several Soviet and US systems are functionally similar, they were not necessarily designed to satisfy identical requirements. Soviet photographic and ELINT reconnaissance satellites [ ] appear designed to satisfy requirements such as maintaining orders of battle of foreign military forces. [ ]

[redacted]

5. All of the Soviets' current satellite systems, with the exception of those for communications and missile launch detection, use near-Earth orbits. Having to maintain several networks of near-Earth ELINT and navigation satellites, which have relatively short lifetimes, requires frequent launches of replenishment satellites. In comparison, the annual satellite launch rate of the United States is about a fourth that of the Soviet Union. The difference in launch rate is due primarily to three factors:

— US satellites have much longer lifetimes.

— [redacted]

— One-third (about 30) of the total annual Soviet launches are photoreconnaissance satellites, all of which return exposed film. The US KH-11 electro-optical imaging system is continually in orbit, returning images in near-real time [redacted]

6. In the 1970s, the Soviets undertook a considerable, expanding effort to develop and use techniques that deny us information useful for assessing the missions and performance of their space systems. [redacted]

7. [redacted]

[ ]

Current and Prospective Soviet Space Systems for Military Support

8. We believe the Soviets will continue to use and improve virtually all of their current types of military satellite systems through the 1980s, and will introduce many new systems as well. Table 1E summarizes current and prospective Soviet military satellite systems.

9. The Soviets are developing a new military space station, and they continue publicly to discuss plans for docking multiple space stations to form a continuously manned space complex. Like previous military Salyut space stations, we expect new ones will carry both low- and high-resolution cameras to serve multiple photoreconnaissance missions. We also expect them to carry additional sensors, such as ELINT and infrared sensors. Data collected by all these sensors could undergo preliminary processing on board and then be passed via data link to Moscow in support of a number of military functions, such as providing indications and warning and maintaining orders of battle, and providing timely data for crisis management and the conduct of military operations. In addition, the Soviets may choose to use manned space stations to conduct subsystem testing of future laser weapon systems.

10. The Soviets are also developing a small reusable "space plane" that will be launched vertically and land horizontally. The spacecraft could serve as a ferry vehicle for space stations or in a reconnaissance or satellite inspection role. It could also provide valuable engineering data for a large reusable space transportation system (RSTS) comparable to the US Shuttle in size and weight. However, a large Soviet RSTS could probably not be operational before the early 1990s. The Soviets' new

Table 1E

Current and Prospective Satellite System Functions

Satellite System Function	Status of Soviet System or Likelihood of Development [a]	Earliest Expected Operation
Multipurpose military space stations	Operational [b]	
Multipurpose (?) "space plane"	In development	Early-to-middle 1980s
Reusable space transportation system	In development [c]	Early-to-middle 1990s
Communications	Operational	
Meterological:		
Near-Earth orbit	Operational	
Geostationary	In development	Early 1980s
Navigation:		
Conventional	Operational	
Advanced (Global Positioning System type)	Moderate [d]	Late 1980s
Photoreconnaissance:		
Film-return systems	Operational	
Film scan system (store-dump)	In development	Early-to-middle 1980s
Electro-optical (real-time)	High [d]	Late 1980s–early 1990s
ELINT reconnaissance:		
Conventional near-Earth orbits	Operational	
Real-time data to naval combatants	Operational [e]	
High-altitude orbits	Moderate [d]	Mid-1980s
Radar ocean reconnaissance:		
Conventional	Operational [e]	
Advanced	High [d]	Late 1980s
Radar imaging (for intelligence)	Even chance	1990s
Early warning:		
Of ICBM launches	In development	Early-to-middle 1980s
Of SLBM launches	Moderate [d]	1990s
Infrared collection (for intelligence)	Low [d]	1990s
Communications intercept	Low [d] [f]	1990s
Telemetry intercept	Low [d] [f]	1990s

[a] Likelihood scale: High=85 to 90 percent; Moderate=65 to 75 percent; Even Chance=50 percent; Low=10 to 30 percent. The scale indicates likelihood Soviets will elect to develop within next 10 years.

[b] Soviets have not flown a military space station since 1977 but could launch one at any time.

[c] *The Director, Defense Intelligence Agency, believes that any Soviet program to develop a large reusable space transportation system is in no more than the conceptual design stage.*

[e] Soviets have experienced problems; exact status unclear.

[f] See text of the Discussion for an expansion on this assessment.

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space station and "space plane" could serve operational purposes in the early-to-middle 1980s.

11. During the 1980s, the Soviets apparently intend to make considerably more use of satellites in high-altitude orbits for communications, meteorology, and navigation. This intention is indicated by the large increase in the production and launch facilities for the USSR's largest operational space booster. Also:

— The Soviets have announced plans to establish five networks with a potential total of 29 geostationary communications

satellites. By the mid-1980s these satellites will provide the Soviets with global communications to aircraft, ships, and ground forces.

— In the early 1980s the Soviets will also place weather satellites into geosynchronous orbit. These satellites, coupled with observations from low-altitude manned space stations and medium-altitude weather satellites, will complete the Soviet "three-tiered network." This network will decrease the Soviets' dependence on meteorological information supplied by the West and will provide them valuable data for planning and executing force movements, exercises, and photoreconnaissance targeting.

— By the late 1980s the Soviets could have an advanced satellite navigation system similar to the US Global Positioning System (GPS). They could elect to incorporate the necessary GPS-type subsystems on an existing high-altitude space system such as their Molniya or Statsionar communications satellites. Unlike their current navigation satellites, a high-altitude GPS-type system would be continuously available and could be used by mobile ground-, air-, and sea-based platforms for precision navigation and accurate weapon and target positioning.

12. There is little intelligence on which to project Soviet development of advanced photographic, electronic, and radar reconnaissance satellites. Judging on the basis of our views of the Soviets' perceived needs, their technological state of the art, and our knowledge of their development cycle, our projections of future Soviet space systems include the following:

— A high likelihood the Soviets will have an advanced photoreconnaissance system equipped to develop film on board automatically and transmit imagery data to a ground station.

— A high likelihood the Soviets will elect to develop a KH-11-type, electro-optical imaging system, which could be operational in the late 1980s or early 1990s.

— A moderate likelihood they will have a high-altitude ELINT reconnaissance system in the mid-1980s, which will provide

nearly continuous coverage of large areas and significantly increase tasking flexibility.

— A high likelihood they will have an advanced radar ocean reconnaissance satellite by the late 1980s, with much improved capabilities to supply targeting data in real time to selected Soviet naval combatants.

— An even chance they will have a radar imaging satellite in the 1990s to provide all-weather, day and night coverage of important targets.

All of these systems will significantly enhance the Soviet capability to obtain more timely data for purposes of indications and warning, maintaining orders of battle on mobile forces, and management of crises and limited conflicts.

13. The Soviets still lack a fully operational network of satellites for early warning of missile launches to supplement their ground-based ballistic missile early warning radars. The US launch detection satellite (LDS) program, which has been in operation for more than 10 years, uses a geostationary orbit to obtain worldwide coverage of ICBM and SLBM launches. The Soviets have been plagued with problems since 1972 in their efforts to establish an operational network. We believe, however, that development of a launch detection program is a high priority for them because of the significant gain in warning time and reliability provided by such systems. We believe that it may be as late as 1983 before the Soviets establish a network for continuous coverage of US ICBM fields. Deployment of an LDS network with coverage of all current and planned US SLBM and ICBM launch areas probably could not be accomplished before the 1990s.

14. The Soviets have both overt and covert access to significant amounts of information on US systems and their operating and performance characteristics. [redacted]

Contribution of Soviet Space Systems to Military Support

15. In developing their vast array of space systems during the last 23 years, the Soviets have been striving to acquire means to provide additional support and to augment their total military capability. Most present Soviet space systems perform military support functions that can also be performed by nonspace systems. During recent years, however, more Soviet space systems perform functions that cannot be

easily duplicated by nonspace systems, thus increasing Soviet dependence on space for military support during peacetime, crisis, and conflict.

16. To measure the military contribution of Soviet space systems, we have grouped space system capabilities in 10 functional areas. Table 2E contains a summary of our assessments of the capabilities of current and projected Soviet satellite systems during peacetime and crisis and limited conflict situations. For most functions shown in the table there are several Soviet space systems that contribute to the net capability. At present, the capabilities of Soviet space systems are weakest in the functions of providing detailed scientific and technological intelligence, indications and warning, and treaty verification. This weakness is due principally to the shortcomings of Soviet ELINT and photoreconnaissance systems. Soviet capabilities are strongest in those functions related to geodesy, navigation, and radar calibration. Improvements during the

Table 2E

Capabilities of Soviet Space Systems and Soviet Dependence on Them

Functions Supported by Space Systems		Peacetime 1980	Peacetime 1990	Crisis and Limited Conflict 1980	Crisis and Limited Conflict 1990
Detailed technical intelligence analysis	Capability	Poor	Poor-Fair	Poor	Poor-Fair
	Dependence*	Low	Low	Low	Low
Calibrating radars	Capability	Excellent	Excellent	Excellent	Excellent
	Dependence	High	High	High	High
Monitoring compliance with treaties	Capability	Fair	Fair-Good	Fair	Fair-Good
	Dependence	Low-Moderate	Low-Moderate	Low-Moderate	Low-Moderate
Mapping, charting, geodesy	Capability	Excellent	Excellent	Excellent	Excellent
	Dependence	High	High	High	High
Observing and forecasting weather conditions	Capability	Good-Excellent	Excellent	Good-Excellent	Excellent
	Dependence	Low-Moderate	Low-Moderate	High	High
Maintaining order of battle and targeting data	Capability	Good	Good-Excellent	Good	Good-Excellent
	Dependence	High	High	High	High
Providing indications and warning	Capability	Fair	Good-Excellent	Fair	Good-Excellent
	Dependence	Low-Moderate	Moderate	Low-Moderate	Moderate
Targeting of antiship weapons	Capability	Not peacetime functions		Fair-Good	Good
	Dependence			Low-Moderate	High
Navigation support to naval combatants	Capability	Excellent	Excellent	Excellent	Excellent
	Dependence	Low	Low	Moderate	High
Military command and control communications	Capability	Good	Excellent	Good	Excellent
	Dependence	Low-Moderate	Moderate	Low-Moderate	Moderate

* Dependence: High (no practical or satisfactory substitute).
Moderate (substitutes available but are not as convenient or do not perform mission as well).
Low (substitutes available that are at least equally practical or adequate).

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1980s in meteorological and communications satellites will lead to strong capabilities in weather forecasting and military command and control.

17. Several of the functions indentified in table 2E provide the Soviets support in peacetime, crisis, and limited-conflict situations that is either unique or difficult to acquire by other means. Most notable are the functions of indications and warning, maintaining order-of-battle and targeting data, weather forecasting, and military command and control communications. The combination of present and likely future Soviet capabilities in these areas between now and 1990 will improve the Soviets' capability for worldwide crisis management and the conduct of military operations.

18. All Soviet space systems rely on unhardened ground-based facilities for launching additional satellites, tracking and controlling satellites, and receiving data from satellites. In an unrestrained US-Soviet conflict, strikes on the Soviet Union could destroy these ground facilities, rendering virtually all of the satellites useless. In recent years, the Soviets have deployed a large number of transportable satellite communication terminals which, although unhardened, have some degree of survivability due to their mobility. The satellites associated with these communication terminals would remain viable for only a few days, however, in the absence of a survivable operational satellite control site.

19. Table 2E also summarizes our assessments of Soviet dependence on space systems. In assessing dependence, primary consideration was given to the availability of nonspace substitutes for the function performed. The three categories of dependence—low, moderate, and high—are defined in terms of such substitutes in table 2E. We assess that in the 1980s the Soviets will become increasingly dependent on space systems for military support during peacetime, crisis, and limited-conflict situations with the deployment of additional and more advanced space systems. This increased dependence will be largely in the areas of indications and warning, command and control communication, and navigation support to naval combatants. Space systems will provide them with more timely information, enhance the capabilities of weapons systems, and extend support to forces deployed outside the Soviet landmass. The Soviets' greatest dependence will be on those space systems that perform a function for which alternative approaches are either unsatisfactory or have not been developed.

20. The Soviets' recognition of the military contribution of satellites has been in part responsible for their acceptance of tacit and explicit US-Soviet agreements during the past two decades not to

interfere with space systems. The Soviets' attitudes toward noninterference have resulted from an amalgam of political and other factors, including their own increasing dependence on space systems for military support functions. Their attitude toward foreign space systems gradually changed over the years from one of general hostility in the 1950s to one of qualified acceptance. They agreed to the 1972 ABM Treaty and Interim Agreement on Strategic Offensive Weapons, which calls for the use of "national technical means of verification" without interference when used in a "manner consistent with generally recognized principles of international law." On the other hand, the Soviets agreed to the 1967 Outer Space Treaty, which prohibits the deployment in space of nuclear weapons and other weapons of mass destruction. The Soviets still hold that certain other space activities cannot be accepted as legitimate. They recognize, moreover, the importance the West places on satellites for supporting military activities.

21. Development of an antisatellite orbital interceptor clearly shows a Soviet desire to have the capability to negate foreign satellites, should the decision be made that such action was necessary. Unless the United States and the USSR agree to prohibit testing of antisatellite systems, we believe the Soviets will continue testing their orbital interceptor. They are now working on a new sensor for their current nonnuclear orbital interceptor. We expect the Soviets to continue design and engineering of a space-based laser system that would have significant advantages over their orbital interceptor for the antisatellite function. They conceivably could have a prototype spaceborne laser weapon for antisatellite testing by the mid-to-late 1980s. As part of such a development program, the Soviets might choose to use their space stations to conduct subsystem testing of low-power laser weapon prototypes.

22. Even if they proceed with development of new and improved spaceborne antisatellite systems, we believe it highly unlikely the Soviets will use them to destroy or otherwise interfere with US satellites in peacetime, crises, or conflicts not involving direct engagements between US and Soviet forces. Three factors upon which this judgment is based are (1) the Soviet desire to limit conflict escalation, (2) the Soviets' own dependence on space systems, and, less importantly, (3) the current US efforts to develop an antisatellite system. In a conflict between US and Soviet forces, the likelihood of Soviet attempts to destroy US satellites using spaceborne means would rise as the conflict escalated. The likelihood of such interference would probably be moderate as long as the Soviets' objectives in a US-Soviet conflict were limited and they believed they could contain the scope and

intensity of the fighting. We believe there is a high likelihood that the Soviets would use spaceborne antisatellite systems in a NATO–Warsaw Pact armed conflict. The likelihood of such use would be very high if the Soviets perceived that general nuclear war was imminent.

DISCUSSION

I. OVERVIEW OF SOVIET SPACE PROGRAM

1. In this section we present an overview of the Soviet space effort from 1957 to present, addressing its evolution, its scope and magnitude, and its organization and management. Subsequent sections discuss the specific capabilities of Soviet space hardware and the ways in which these systems serve the Soviet military during peacetime, as well as during periods of crisis and conflict. A separate section focuses on the Soviets' ability to use their own space systems to negate those of other nations.

2. In this section comparisons with US space efforts are included where they can serve as useful benchmarks for understanding Soviet capabilities or philosophy. These comparisons should not be interpreted as technical assessments showing Soviet satellite systems to be superior or inferior to US satellite systems. The space programs of the United States and the USSR have evolved in response to their perceived national needs, which are, in many cases, quite different. For example:

- US intelligence collection requirements resulted in satellite systems to collect communications signals. The Soviets have no similar systems.
- Soviet military requirements resulted in an orbital interceptor for engaging satellites of other nations, radar support satellites for calibrating ABM radars, and radar and ELINT ocean reconnaissance satellites for transmitting targeting data in real time to selected naval combatants.
- Although some US and Soviet satellite systems are of the same type (photographic and ELINT collection satellites, for example), they were not necessarily designed in response to the same requirements. Therefore, while a specific Soviet satellite system may appear inferior to a similar US satellite system, it may fully satisfy Soviet requirements.

Evolution of the Soviet Program

3. The early years of the Soviet space program were dominated by heavily publicized space flights with limited scientific objectives. The early scientific and manned missions in low Earth orbit, as well as the lunar and planetary missions, relied on space boosters derived from ballistic missiles. This general approach provided a series of space "firsts" that made headlines, had a fair probability of success, and were not overly expensive. The clear intent was to enhance the image of the Soviet Union as a technical, scientific, and military power.

4. In the mid-1960s, the Soviets began to broaden the objectives of their space program by launching newer series of satellites with practical military and economic applications. While those directed toward meteorology and civil communications received some publicity, others such as those for photographic and ELINT reconnaissance, radar calibration, covert communications, navigation, geodesy, and satellite interception were masqueraded as part of a continuing program of scientific research.

5. To move beyond their earlier publicized successes in space, the Soviets began in the late 1960s to test larger and more complex space boosters and spacecraft. They encountered serious setbacks in these programs and did not move forward as they had expected. Their failure to develop a large booster for manned lunar missions, coupled with the US lead in the Apollo Project, led the Soviets to redirect the emphasis of their man-in-space program to Earth-orbiting space stations.

6. Since the early 1970s, the Soviets have concentrated their effort on space systems for military support. They improved the capability of their ELINT and photoreconnaissance satellites, developed radar and launch detection satellites, and developed a geosynchronous communications satellite network. At the same time, they have sought to maintain the image of Soviet prowess in space by heavily publicizing the missions of the Salyut space stations.

7. Figure 1 summarizes the proliferation of Soviet spacecraft types discussed in the preceding paragraphs. This large array of spacecraft has been developed through a building block approach which emphasizes an evolutionary design philosophy. In this approach, the Soviets have developed several basic spacecraft designs and, over time, have incorporated new missions and improved capabilities into them. Despite some setbacks during developmental flight tests, their general approach of retaining both old and new systems has resulted in a large number of different satellite types.

8. During the early 1960s the Soviets substantially increased the level of effort devoted to space system design and development. As a result they introduced many new space systems in the mid-to-late 1960s. Since then, they have maintained a fairly constant level of spacecraft design and development. Clearly, they remain committed to a diverse program to serve various military and civil programs.

Scope and Magnitude of Soviet Program

9. After the launching of Sputnik in 1957, the number of successful space launches conducted annually by the Soviet Union steadily increased, reaching a maximum of 98 in 1977. In 1967, the Soviet launch rate surpassed that of the US program for the first time since the initial year of 1957. And for the past 10 years the Soviet launch rate has been three to four times that of the United States. The annual launch rates for the USSR and the United States are shown in figure 2.

10. In terms of the total payload weight to orbit, the Soviets currently orbit about 10 times the US total each year (about 300,000 kilograms for the USSR versus 30,000 kg for the United States). While the Soviets annually deploy a considerably larger number of payloads and more total weight in orbit, the United States places a greater proportion of its payloads into higher orbit. Thus, if all launches for both countries are converted into an equivalent weight delivered to a 185-kilometer circular orbit, the ratio would be 4 to 1 in favor of the Soviets.

11. While the annual number of launches and amount of payload weight to orbit give some measure of the gross magnitude of the Soviet program, perhaps a more useful parameter is the number of active satellites, as shown in table 1. The number generally operational is about equal to the annual launch rate.

Table 1

Categories and Numbers of Soviet Satellites Usually Operational

Satellite Category		Number Usually Operational
Launch detection		1-3
ELINT reconnaissance		8-10
ELINT ocean reconnaissance		0-2
Radar ocean reconnaissance		0-2
Naval support		9-11
Geodetic		1-3
Manned/manned-related		1-3
Meteorological		6-10
Communications		37-46
Radar support		2-6
Orbital interceptor		0-1
Target vehicle		0-1
Photoreconnaissance		1-4
Scientific		4-10
Total		70-112
Subtotals:	Military	46-75
	Military/Civil	20-27
	Civil/Scientific	4-10

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This is because many launches are for short-lived photoreconnaissance missions, and few Soviet satellites have lifetimes exceeding 18 months. The United States makes much more use of geostationary orbits, a practice that requires fewer satellites for continuous coverage of large areas. Even with fewer annual launches than the Soviets, the United States usually has about 100 satellites in operation. It maintains about the same number of satellites in operation as the Soviets because the US satellites have much longer operational lifetimes, requiring fewer "replenishment" launches.

12. Clear distinctions between Soviet military and civil space programs are not always possible because some systems perform both military and nonmilitary functions, as shown by the spacecraft categories in figure 3. For example, although the scientific Salyut space station program is primarily civil, the Soviets have conducted some experiments on board the Salyut that have important military, as well as civilian, applications. Figure 4 illustrates Soviet space launches since 1957 for each of these categories. It shows that the space programs serving only the military are by far the most active, usually accounting for about 70 percent of the launches each year. It also shows that the dual military/civil programs have grown significantly since the early 1960s and account for around 15

Figure 1
Proliferation of Soviet Space Systems, 1957–79

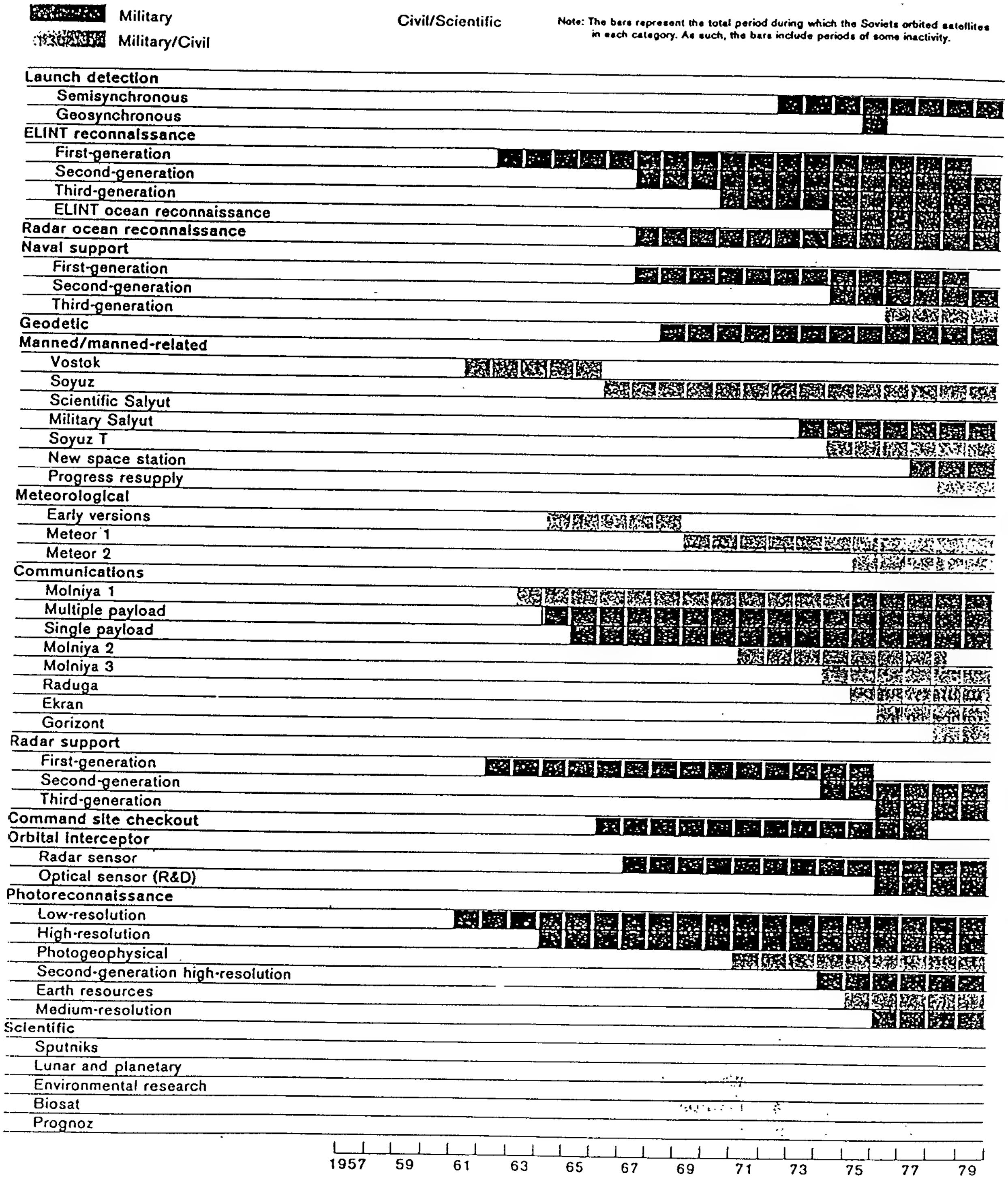

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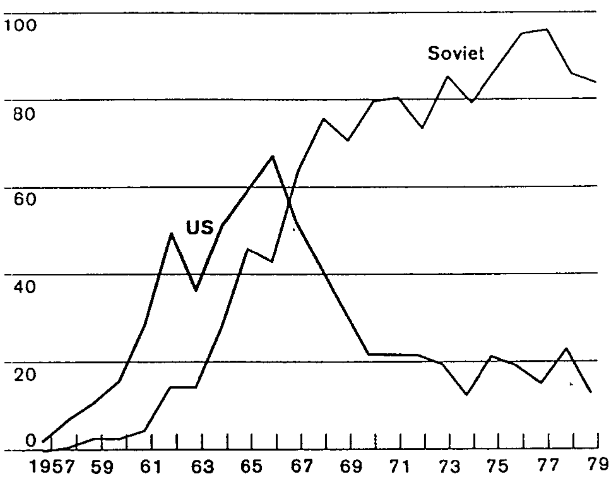
Figure 2
Number of Successful US and Soviet Space Launches, 1957-79



Note: Does not include launches for other nations or international organizations.

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percent of the annual total. The purely scientific systems account for less than 15 percent. By comparison, the approximately 100 operational US systems are about 50 percent civil and 50 percent military or military support. The latter category includes intelligence collection systems, which account for 25 percent of the US total.

13. To support their large number of operational satellites, the Soviets have deployed an extensive network of ground stations, all within the USSR. The growth of this network has corresponded with the growth in numbers and types of spacecraft, and continues even today. The expanse of the Soviet Union permits ground stations within the country—shown in figure 5—to have a large amount of access time to Soviet satellites. However, the Soviets have still found it necessary to supplement this network with a fleet of space support ships for supporting space events (such as deorbit or orbital injections), and six smaller instrumentation ships for support of space launches. [redacted]

14. The United States has nearly an equal number of facilities, for telemetry, tracking, and command. It does not regularly use ships to support missions, but has placed ground stations on foreign territory worldwide. The US stations are independent and support specific space missions (those of the Defense Department or NASA, or intelligence, or domestic communications satellites). For the most part, the Soviet stations form a unified network under the guidance of a single central authority, providing them considerable flexibility in command and control of their space systems.

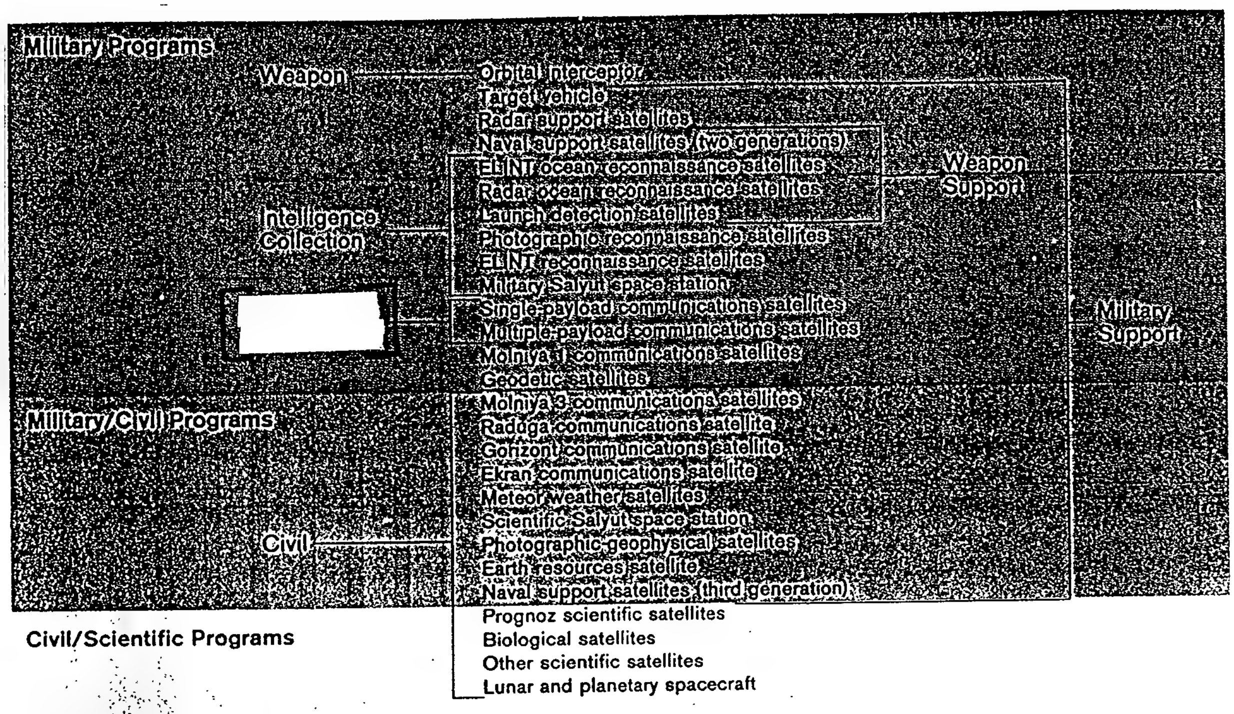
Space Launch Vehicles

15. The Soviet space program, like its US counterpart, has relied heavily on the use of ballistic missiles as space launch vehicles (SLVs). The Soviet family of SLVs includes vehicles based on the SS-5 intermediate-range ballistic missile and the SS-6 and SS-9 intercontinental ballistic missiles (see figure 6). By using these proven missile systems along with a series of upper stages, the Soviets have greatly simplified SLV development.

16. In mid-1965, the Soviets began flight-testing a large new two-stage space booster comparable to the US Saturn IB in size and to the US Titan IIIC in function. By 1968, they had successfully developed three-stage (SL-13) and four-stage (SL-12) versions of this booster, which they refer to as the "Proton." The Proton-based SLVs represent the only launch vehicles successfully developed by the Soviets strictly for use as SLVs.

17. Nearly concurrent with development of the Proton, the Soviets were busy trying to develop an even bigger booster. This vehicle, which was comparable to the US Saturn V in size (but not in performance), [redacted] had an estimated lift capability on the order of 100,000 kg to near-Earth orbit and about 35,000 kg for lunar return missions. The Soviets made three attempts during the period 1969-72 to test-fly this booster, which was intended for manned lunar missions. All three attempts ended in failure, and the program was apparently canceled in 1974. We believe the Soviets are currently developing a family of new large space boosters that will use many of the launch and support facilities originally constructed for [redacted] The new vehicles probably will be about the same size [redacted] but some variants could have a greater lift capability due to

Figure 3.
Soviet Spacecraft Categories



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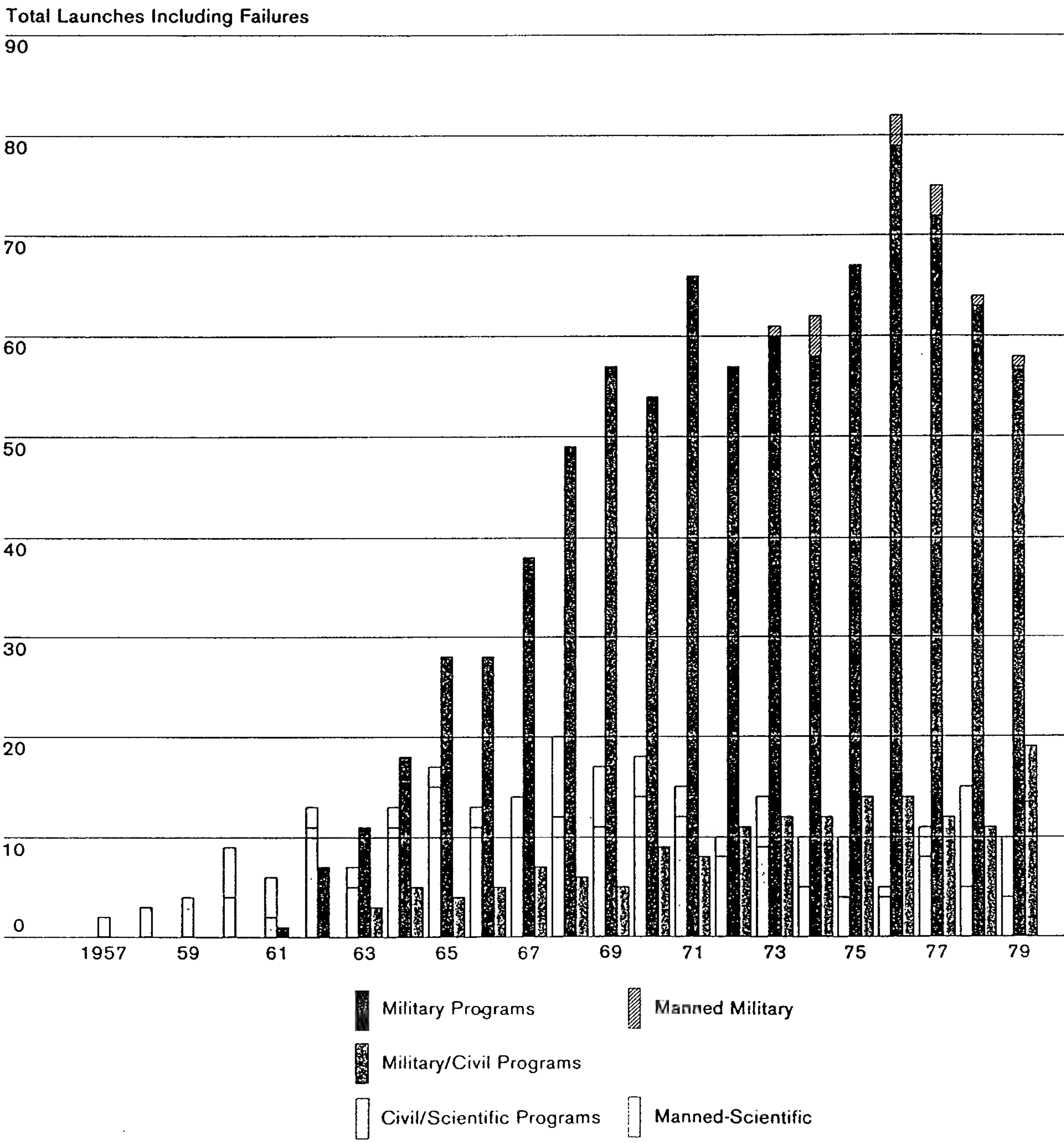
advances in design and propulsion. The most significant advance will be in the use of high-energy (liquid hydrogen) upper stages, which could allow the Soviets to place 180,000 kg into low Earth orbit. In addition to these large boosters, the Soviets are developing a smaller SLV with a liquid hydrogen upper stage that will probably have a payload capability of 14,000 kg to low Earth orbit.

18. We believe the Soviets will continue the use of expendable SLVs for the next decade. They are refurbishing older launch sites and building new ones. And they are increasing the production rate of their SL-12/13 SLVs, as well as preparing to introduce new, expendable SLVs. The new large space boosters that will enter flight test at Tyuratam in the mid-1980s will probably be used in the late 1980s to launch very large space stations and heavy lunar and planetary spacecraft, and could be used for orbital tests of a reusable space transportation system comparable in size and weight to the US space shuttle orbiter.

Soviet Space Hardware Costs

19. Figure 7 depicts Soviet investment in space hardware for both military and civil/scientific programs for the period 1960-79. The dollar cost estimates shown in figure 7 represent what it would cost in the United States to duplicate the Soviet programs, using US cost factors and pay rates. Costs are expressed in 1979 dollars. This hardware cost estimate excludes

Figure 4.
Soviet Space Launches by Category

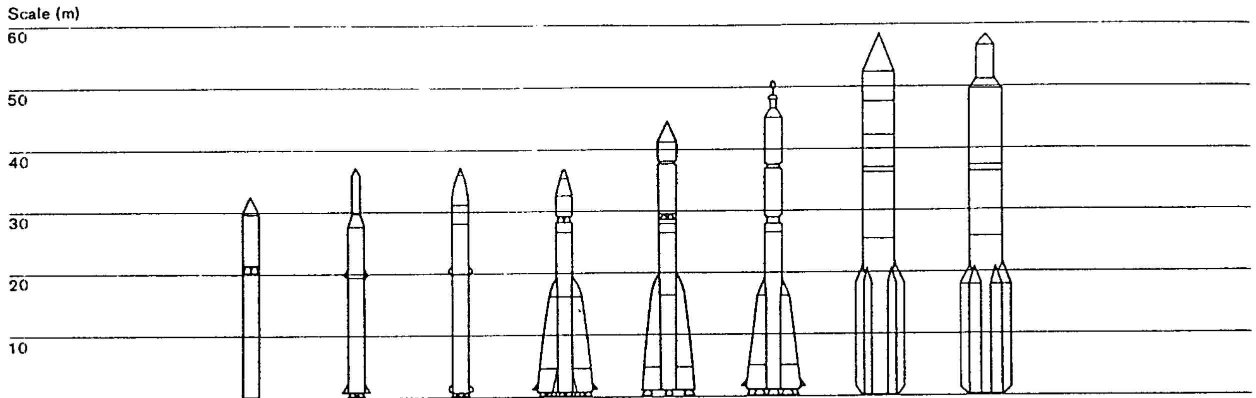


research and development, administration, tracking and data acquisition, and the construction of new facilities. The absolute values shown for annual expenditures contain large uncertainties and should be regarded as approximations. We have more confidence in the validity of the trends depicted and in the relative costs of military and civil space hardware than we do in the absolute values for annual costs.

20. In the past six years Soviet investment in space hardware is estimated to have cost the equivalent of $5-7 billion per year. Despite the large number of military spacecraft launched each year, the hardware costs of most of these missions is incrementally much smaller than that of most civil missions. In our derivation of the annual spending for space hardware, we have allocated the cost of spacecraft having both military and civil missions according to our judgment of the proportion of the program devoted to each mission. On this basis the annual cost of civil and military programs during the last two decades has been about the same. In the late 1960s the high expenditures on lunar efforts drove civil costs above military costs. In the mid-1970s the large expenditures on new military programs, principally manned military space stations, caused military costs to exceed civil expenditures. The rise in civil/scientific costs in the last few years is attributed to the deployment of more complex geosynchronous satellites for civil communications and the initiation of the Salyut-6 scientific manned space station program.

21. During the past six years the Soviet manned space effort, which has military as well as civil and scientific purposes, has been the single most costly program, accounting for 15 to 20 percent of total space hardware costs. The cumulative costs through 1979 of the Salyut-6 mission alone—consisting of the space station, 10 Soyuz ferry spacecraft, seven Progress resupply vehicles, one Soyuz-T, and 19 launch vehicles—reached almost $2 billion. During this period, expenditures for military programs have accounted for somewhat more than 3 percent of total Soviet military procurement.

Figure 6
Soviet Space Launch Vehicles, Payloads, and Launch Sites



	SL-8[a]	SL-11[b]	SL-14[b]	SL-3[c]	SL-6[c]	SL-4[c]	SL-12	SL-13	?	?
Payload weight (kg) to 185-km orbit	1,600	4,000	5,000	5,900	7,000	7,000	18,000	19,000;	180,000	14,000
Payloads	Naval Support Geodetic ELINT (2nd Gen.) Radar Support ASAT Target Scientific	ASAT Intercept Radar Reconn. ELINT Ocean Reconn	ELINT (3rd Gen.) Scientific	ELINT (3rd Gen.) Meteorological	Molniya Prognoz Launch Detect	Soyuz Progress Photoreconn Cos. 670-type	Ekran Gorizont Raduga Venera Mars Luna	Salyut Cos 929-type Dual Payload		
Launches per year	28	7	3	6	10	38	6	2	?	?
Launch sites										
Kasputin Yar 7C										
Plesetsk 1[e]										
2										
3										
9[e]										
10[e]										
27[e]										
Tyuratam A-1										
B-1										
G-1A/B										
G-3/4										
U-1/2										
J-1/2										
W										
Y										

Site being refurbished, modified, or newly under construction

Active launch site

[a] Derived from SS-5 IRBM
[b] Derived from SS-9 ICBM
[c] Derived from SS-6 ICBM
[e] These sites have two launch pads

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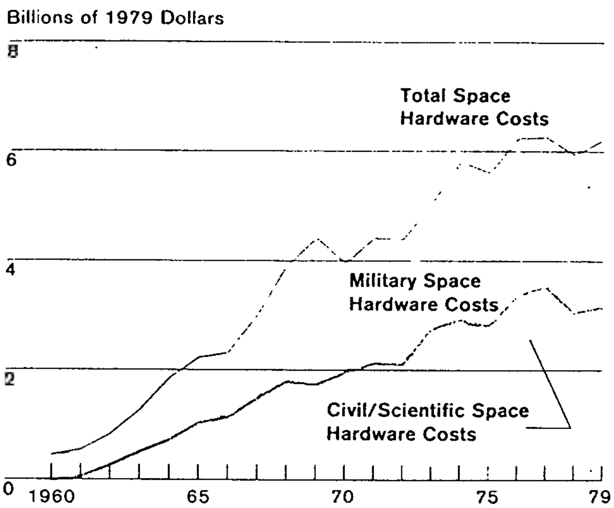
Figure 7
Soviet Space Hardware Costs



Costs of joint military/civil spacecraft have been apportioned according to mission purpose.

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Management and Organization of Soviet Space Program

22. Broad national space policies and goals are established by the Politburo, which also has the ultimate decisionmaking authority for space issues and policy. A key figure in the decisionmaking apparatus is the party secretary for defense affairs. This "supermanager" has responsibility to monitor all matters related to the development of military weapons and space systems. The position carries great authority, including command over resources of all party and government organizations devoted to military and civil space research, development, and production.

23. The second critical level of the decisionmaking hierarchy consists of the governmental organizations under the Council of Ministers. Figure 8 depicts the management organization at this level responsible for both military and civil space programs. The Military-Industrial Commission (VPK) oversees major development programs, enforces deadlines, and arbitrates program-related controversies. The Academy of Sciences probably exercises control over the basic research aspects of the Soviet space program. The Academy's Institute of Space Research (IKI) directs the development of prototype space instrumentation and assists the appropriate ministries in determining the best allocation of assets for making the hardware.

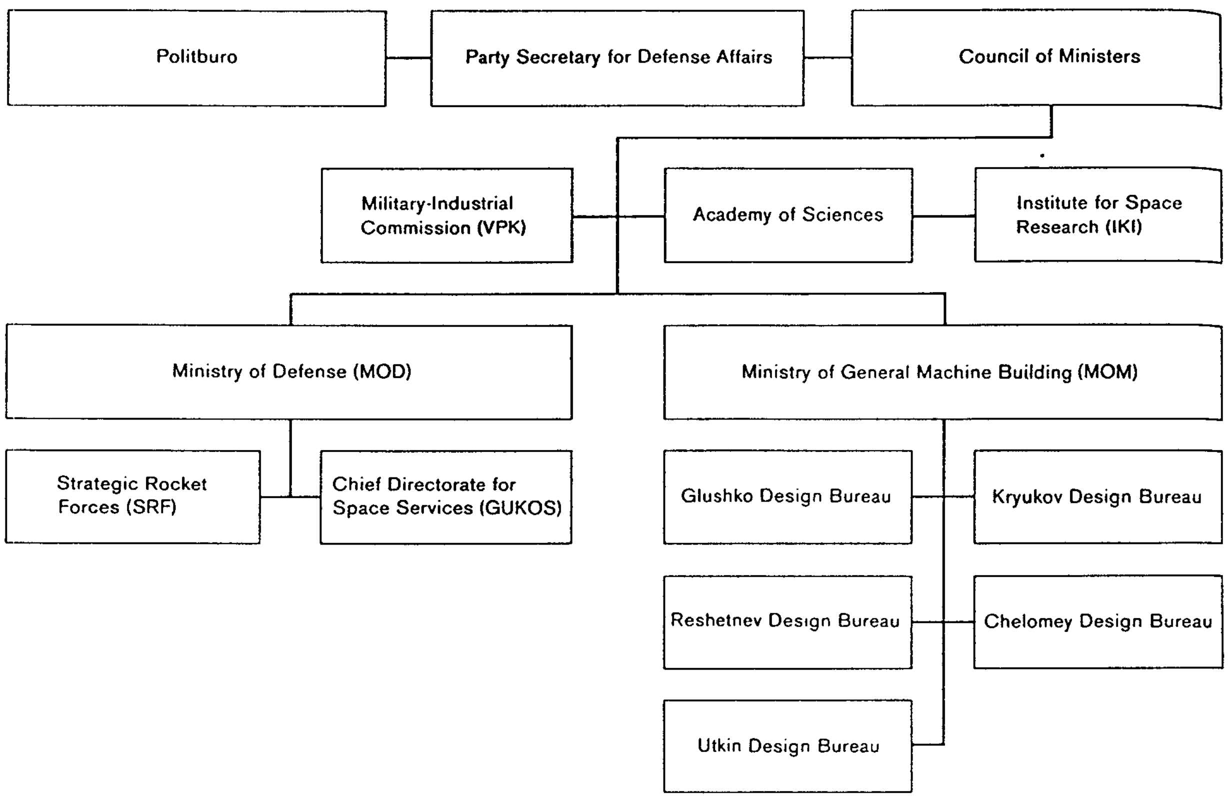
24. The Ministry of Defense (MOD) monitors the quality of materials and components manufactured at all facilities.

25. The Ministry of General Machine Building (MOM) has assigned the responsibility of designing new civil and military space systems and improving older systems within five of 13 major design bureaus. Each of these design bureaus is functionally equivalent to a US aerospace corporation. Their task is to translate feasibility studies from the scientific community and requirements from the military into operable space systems. To complete this task, design bureaus perform conceptual designs, fabricate mockups and prototypes, and conduct overall systems integration. In table 2, we have identified the principal customers for Soviet space systems and the design bureaus which we believe were responsible for developing the systems.

26. The production of space systems appears to be conducted under the supervision of design bureaus, but at plants not necessarily subordinate to them. Pilot plants, often colocated with a design bureau, may actually produce all of those spacecraft which are expended in limited quantities. In the case of frequently launched SLVs and spacecraft types, series production may occur at independent plants. In the latter case, however, we believe that the design bureaus have representatives at the plants to ensure that performance standards are met, conduct quality control measures, and suggest ways to improve production efficiency.

27. During the 23 years of their space program, there has been no significant change in the Soviets' highly standardized development process. This process, which is similar for missile and space systems, typically covers a 10- to 15-year time span. Once the decision is made to proceed with development of a new technically complex space system, an estimated seven to 10 years is required to complete the design,

Figure 8
Management and Organization of Soviet Space Program



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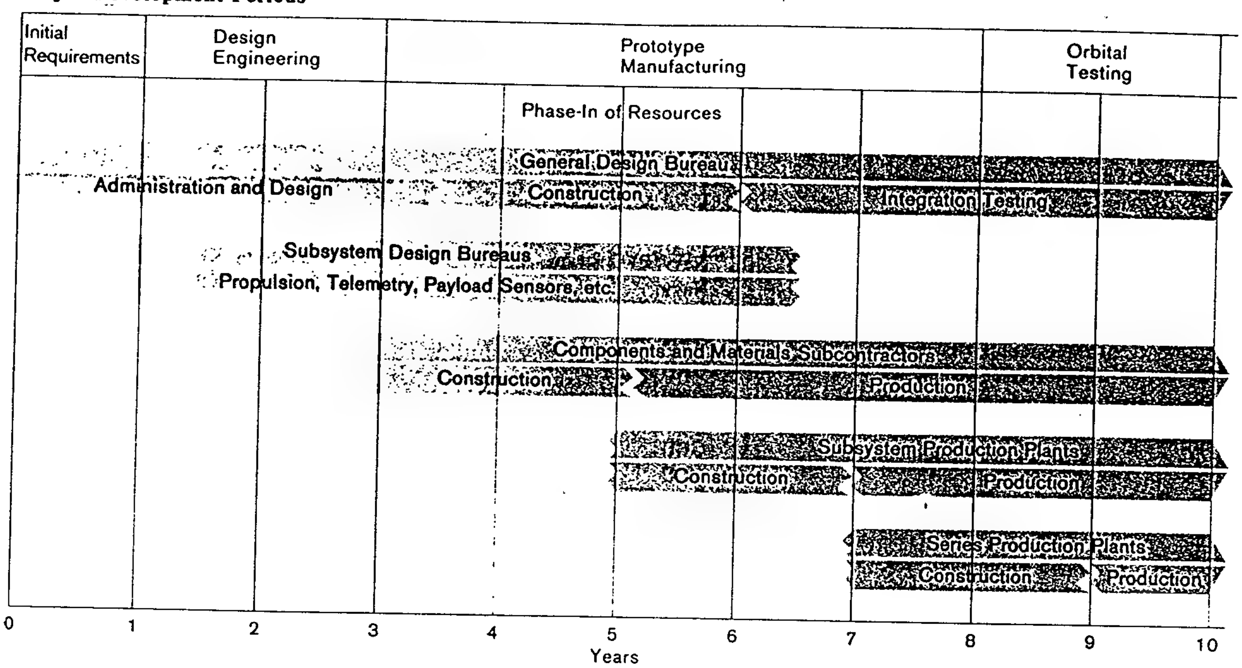
engineering, and manufacturing phases of development before flight-testing of a prototype. Many of their more recent spacecraft programs have required excessive time to correct major problems that become apparent in the flight test phase, which normally lasts two to four years. Figure 9 depicts the typical time line for development of a Soviet space system if no major difficulties are encountered.

28. The Soviet method for developing space systems has several advantages, as well as disadvantages, when compared with the methods used in the United States. Because Soviet design bureaus are highly specialized and form a permanent part of the bureaucratic establishment, funding and employment levels are more stable and not subject to the frequent disruptions inherent in a competitive contracting environment. This fairly static space management process operates in a complex manner, however, and does not appear to have a central coordinating agency. Central direction is apparently attempted through various coordinating devices that in the United States have been centralized within NASA or the Department of Defense. The system is not adaptive, and it lacks the ability to recognize and solve complex problems in a short time. However, Soviet missile and space system development practices have fostered the growth of powerful individuals who often operate outside the standard channels of Soviet management to solve problems which arise within their programs. This has helped the Soviet space effort overcome some of its shortcomings.

Figure 9
Stages in Typical Development Program for Soviet Space Systems



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II. CURRENT AND PROSPECTIVE MILITARY SUPPORT SPACE SYSTEMS

29. In this section, we address the capabilities and limitations of current Soviet military support space systems. We make near-term projections based on some direct evidence, on trends in Soviet spacecraft development, and on identified deficiencies in current systems. We make longer term projections based on our views of the Soviets' perceived needs, their technological state of the art, and our knowledge of their development cycle.

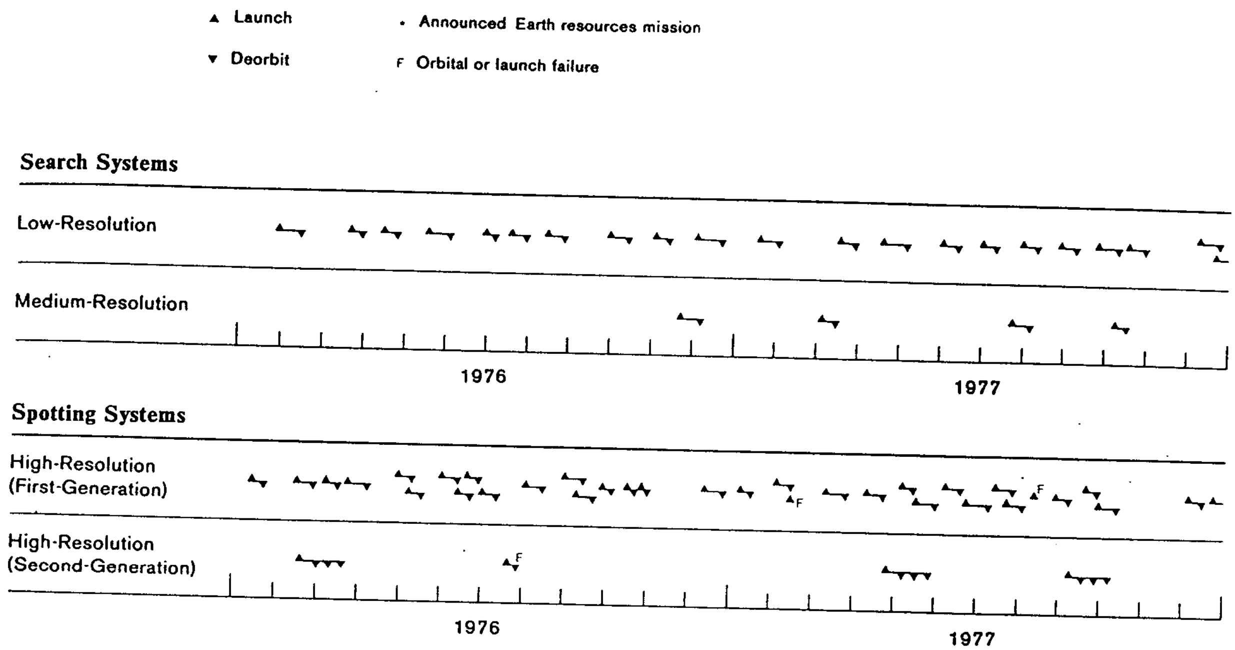
30. While we believe that our current knowledge of the technical characteristics, performance, and uses of most current Soviet satellite systems is adequate, two factors limit our understanding of these systems. First, the large number of Soviet space systems operational and under development has forced us to be selective in the allocation of our collection, processing, and analytic resources. Second

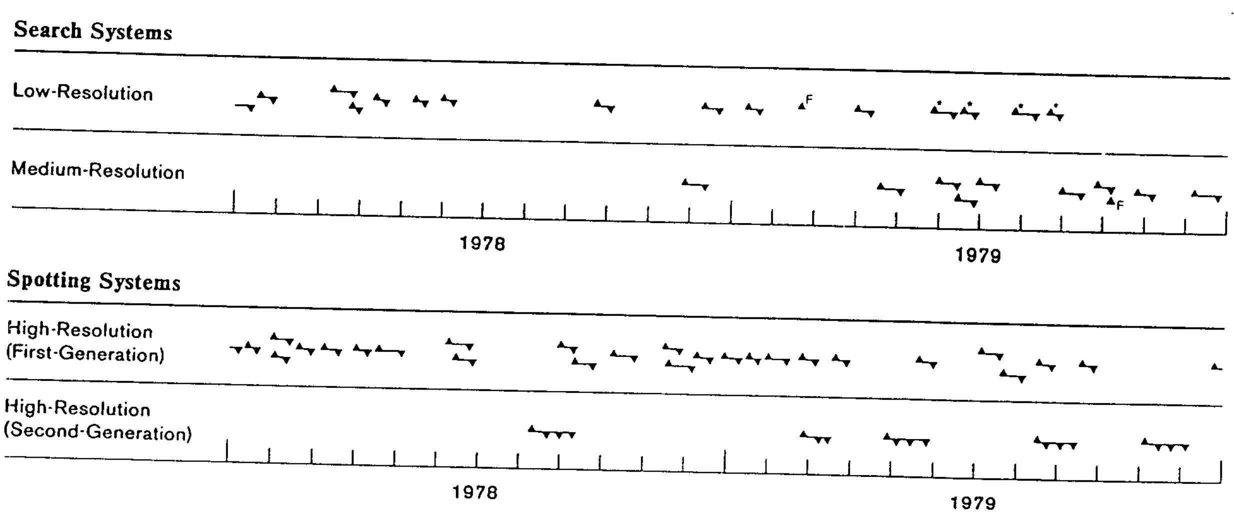
We believe they will continue using such information-denial techniques and will probably expand their use.

Unmanned Photoreconnaissance/Imaging Satellite Systems

31. Photographic reconnaissance is by far the most active Soviet space program in terms of launch frequency. About one-third of all Soviet spacecraft launched each year have photoreconnaissance missions. Figure 10 shows the launch and recovery activity over the past four years of those Soviet photoreconnaissance satellites having a primary mission of intelligence collection. The high launch rate has been dictated by an apparent operational requirement to

Figure 10
Soviet Photoreconnaissance Satellite Activity, 1976-79





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obtain nearly continuous photographic coverage using space systems that are technically limited. The Soviets' photographic satellites use space vehicles originally designed as manned spacecraft and are too heavy to be placed into sun-synchronous orbits by the booster currently used. Also, most of these satellites are battery powered and thus have limited lifetimes. As a result the Soviets have opted for short-duration missions in orbits where lighting conditions remain favorable for only limited periods of time. Further, their film technology has restricted the total capacity of their satellites. We believe these technical limitations led to a choice of 13 days for the majority of their missions. Over the last six years the Soviets developed a photoreconnaissance satellite [redacted] enabling them to stretch some missions to 44 days. Orbital maneuvers allowed for maintenance of favorable lighting conditions. The Soviets have no system with timeliness comparable to the KH-11, which is continually in orbit and transmits imagery [redacted] in near-real time.

32. To gain more timely data, the Soviets have on occasion launched several photoreconnaissance satellites in a short period of time. For example, during the 1973 Middle East war, they launched seven photoreconnaissance satellites in 24 days and deorbited most of them about six days after launch. Multiple launches within short periods are possible with a limited number of launch pads because the Soviets have developed systems with short on-pad stay times. The Soviets fuel the spacecraft, mate it to the booster in a horizontal position, and perform all of their subsystems checkout in checkout buildings located near their launch sites. (Although the United States also employs a limited number of launch pads, all of these time-consuming mating and checkout functions are performed while the booster is erected vertically on the launch pad.) The mated booster and spacecraft are then taken to the launch site and erected; the booster is fueled; and the vehicle is launched in as short a time as four hours after leaving the checkout building. In 1969, the Soviets demonstrated a minimum time of two days between successive launches from the same launch pad.

33. Table 3 lists the Soviet photoreconnaissance satellite system types and their most important capabilities. The estimated best resolution of the best Soviet system is 12 inches [redacted] The second-generation, high-resolution system is the first to make operational use of film-return capsules and solar panels to increase mission duration. Alternatively, with this system the Soviets can increase the timeliness of the data by deorbiting capsules early without having to launch a new photoreconnaissance satellite.

34. The annual number of launches of these systems has remained relatively constant for several years. In 1979, however, the launch mix of systems changed significantly (see figure 10); this change is probably a harbinger of future activity. Two of the the Soviets' newest photoreconnaissance systems, the medium-resolution and the second-generation high-resolution, appear to be fully operational. This has given the Soviets greater flexibility in their photoreconnaissance program.

35. It appears that the Soviets have phased out the use of the low-resolution system for search missions, supplanting it with the medium-resolution system. By doing this, they have sacrificed the large amount of area coverage the low-resolution system normally provided. The Soviets could counteract this loss by launching large numbers (more than 20) of medium-resolution systems each year, which is unlikely. It is more likely that they will supplement the medium-resolution coverage with data obtained from low-resolution Earth-resources missions and space stations (when available).

36. For spotting missions, the Soviets have begun to rely more on the second-generation high-resolution system, cutting in half the number of first-generation high-resolution systems launched annually. [redacted] However, the Soviets lose little if any area coverage with the apparent new mix, and gain in the amount of higher resolution photography.

37. We expect the Soviets to continue using some mix of these current satellite systems, with the possible exception of the low-resolution system, for the next several years. Evolutionary improvement in photographic quality is expected to continue. They may introduce film-return capsules on other photo systems

to further increase mission lifetimes. However, we expect them to maintain their ability to orbit short-duration missions quickly.

38. Additionally, we believe the Soviets perceive the many advantages of a near-real-time imaging satellite system like the US KH-11. Such a system in sun-synchronous orbit would provide them much greater responsiveness to changing collection requirements (such as during crisis), and could eliminate the need for the costly, frequent launches of their current film-return systems. We believe they will have the necessary critical technology—large arrays of electro-optic sensors or charge coupled devices—for a near-real-time imaging system, as well as that required for data-relay satellites, by the early 1980s. Although we have no evidence of Soviet intentions to develop such a system, we believe that it is highly likely they will elect to proceed with system development. If the decision has already been made, the first orbital flight test could occur in the late 1980s or early 1990s.

39. As an interim measure to acquire imagery more rapidly, the Soviets may use a photographic satellite system equipped to develop film on board automatically and transmit imagery data to a ground station.

If such an interim system proves effective, development of a real-time imaging system may be delayed.

40. A radar-imaging system could augment the USSR's photoreconnaissance satellite systems by obtaining images in all types of weather and lighting conditions. The critical technology for such a system is specialized signal and data processing, which we believe the Soviets could have in the early-to-middle 1980s. Solely on the basis of our view of Soviet perceived needs, we believe that there is about an even chance the Soviets will decide to develop such a system. If they do so, an orbital flight test is not expected before the 1990s.

ELINT Reconnaissance

41. The Soviets' program to collect ELINT began concurrently with their photoreconnaissance program. The first ELINT collection was from the second Soviet low-resolution photoreconnaissance satellite, which was launched in 1962.

It appears the Soviets have phased out the "piggyback" ELINT package on the low-resolution photo missions.

42. The Soviets have two operational satellite-borne ELINT reconnaissance systems that apparently have been designed to collect data of sufficient quality to identify land- and sea-based radar types and, in some cases, to locate radar emitters. Another system, designed for ELINT ocean reconnaissance, has been under flight test development since 1974 and may be nearing an operational status.

The Soviet systems were apparently designed to specifications that emphasized coverage of US sea-based radar systems, and to use the data primarily for the purpose of locating ships.

43. The Soviets have made evolutionary improvements to their satellite ELINT systems over the years. Their third-generation system, introduced in 1970, was the first to have an integral direction-finding capability. It also has improvements over the second-generation system

44. In late 1974, the Soviets launched their first ELINT ocean reconnaissance satellite (EORSAT). This system has the capability to provide targeting data in real time to Soviet naval combatants, as well as to store for later transmission to Moscow.

45. At least 10 Soviet naval combatants are currently configured to receive the EORSAT data. Major limitations of the EORSAT system include the following:

— Ships using emission control could go undetected.

— The time between accesses to ocean areas near the equator is excessive (measured in days).

— Demonstrated satellite lifetime is short (one to five months) relative to other ELINT collection satellites.

46. We believe the Soviets will continue using their third-generation ELINT satellite and the EORSAT for the next several years.

Improvements in the USSR's EORSAT program will probably include use of multiple satellites to improve access time, more Soviet naval combatants fitted to receive the data directly, and a greatly increased lifetime.

47. Additionally, the Soviets may perceive the advantages of ELINT-collection satellites designed for operation in geosynchronous or semisynchronous orbits. Advantages of high-altitude satellite collectors, include continuous access to areas of high interest

48. We believe the Soviets have the necessary technology to develop a high-altitude ELINT collection

system. While we have no direct evidence that they intend to do so, we note that the Soviet military is sponsoring work on large spaceborne antennas (the 10-meter-diameter antenna deployed on Salyut 6, for example, was developed under military sponsorship). Large, high-gain antennas are required on collection satellites at high altitude to provide the necessary sensitivity for the detection of low-power signals radiated from emitters on the Earth's surface. On the basis of the listed advantages of high-altitude ELINT collection systems, continued Soviet interest in ELINT collection by satellites, and military-sponsored development of suitable antennas, we believe there is a moderate likelihood the Soviets are developing such a system. Assuming they are, we expect that the first orbital flight test could occur by the mid-1980s. If such a satellite had the necessary receiver sensitivity, frequency coverage and antenna size, it would have the capability to intercept telemetry and communications signals. Because Soviet requirements for such systems may not be compelling, we believe that the first orbital flight tests of a system dedicated to telemetry and communications intercept will not occur before the late 1980s.

Radar Reconnaissance

49. The Soviets initiated flight tests of their radar ocean reconnaissance satellite (RORSAT) system in 1967. This system uses a surveillance radar to detect and locate ships of destroyer class and larger. It can be programed to transmit the data in real time to selected naval combatants. The Soviet satellites are launched into circular orbits 280 kilometers above the Earth. After mission termination, a segment of the spacecraft containing a small nuclear reactor for generating electric power is separated and commanded into a higher (900 kilometers) orbit, where it will remain for 500 to 1,000 years, allowing time for decay of the radioactive fuel. The United States has no space-based radar system comparable to the Soviet RORSAT.

50. The RORSAT is not an imaging system. Radar return (echo) signals are processed only if they are very strong, as from a large ship.

51. Major advantages and capabilities of the RORSAT system are as follows:

The RORSAT system also has some major limitations, as follows:

52. The RORSAT program has experienced numerous onboard system failures. Table 4 lists all the RORSAT launches to date and, where known, the cause of failures. The failures have been due to various causes, making it difficult for the Soviets to correct all problems and produce a reliable system.

53. The Soviet RORSAT program suffered a major setback in January 1978, when a RORSAT, including its nuclear reactor, made an unintentional reentry, scattering radioactive debris in Canada's Northwest Territory. The resultant adverse world reaction to the use of nuclear power sources in space led to deliberations in the UN outer space subcommittees where a majority of nations supported regulations for the use of nuclear power sources, including a ban on their use in low Earth orbits. Despite these reactions, the Soviets launched the first RORSAT since the Canadian incident in April 1980, after a 27-month standdown. The long hiatus was undoubtedly to allow time for necessary technical modifications but the modifications probably do not account for the full 27-month period, because the latest RORSAT appears to have a configuration nearly identical to that of previous satelltes in the program. A possible factor influencing the Soviet decision to resume launches in this program may have been the need to obtain better coverage of US naval activities in the Arabian Sea.

54. This most recent RORSAT launch clearly indicates the Soviets will continue their RORSAT program despite adverse world reactions to the Canadian incident. The Soviets must continue the use of the nuclear reactor in the current RORSAT design since the low orbit prohibits the effective use of large solar arrays to satisfy the large and continuous power requirements of the radar system. Soviet goals for this program probably include increasing RORSAT lifetime significantly

beyond the 74 days seen so far by eliminating system problems causing premature failures. We estimate that the quantity of onboard propellants for orbit maintenance is sufficient for mission durations of about 150 days. (The nuclear reactor power supply would be good for at least a year.) We expect the RORSAT program will evolve into new generations of space-based radar systems. On the basis of evolutionary trends in most Soviet space systems and of our estimates of current RORSAT limitations, we believe the Soviets will, by the late 1980s, develop an advanced version of the RORSAT that will be able to operate under adverse weather conditions and be able to detect small ships.

55. Data collected by both imaging and advanced nonimaging space systems will add to Soviet knowledge of the feasibility of detecting surface effects produced by ships and submerged submarines [redacted] The feasibility of detecting surface effects of submerged submarines remains highly questionable.

Missile Launch Detection

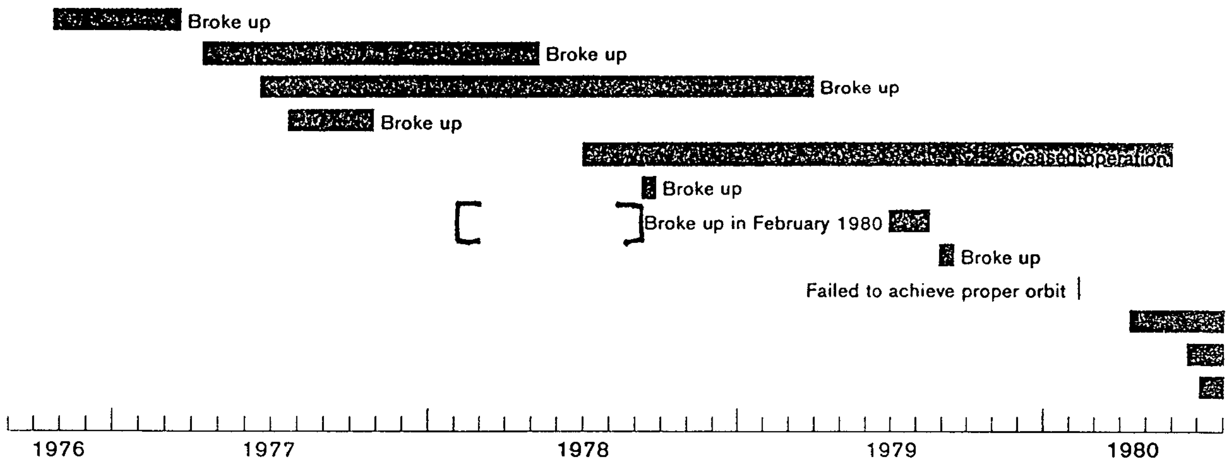
56. The Soviets began flight tests of a missile launch detection satellite (LDS) system in 1972. The first phase of the LDS program consisted of five developmental flights—four into semisynchronous orbits and a fifth (1975) into a geostationary position over the South Atlantic. [redacted] None of these first phase satellites is currently operational.

57. A new phase of this program, which began in late 1976, represents a Soviet effort to establish an operational network of satellites using the semisynchronous orbit. [redacted]

58. The Soviets have been plagued with problems since 1972 in their efforts to establish an operational network. By the way of contrast, the United States has had an operational network of satellites for early warning of missile launches for more than 10 years. The US program uses three satellites designated DSP (Defense Support Program) in geostationary orbit to obtain worldwide coverage of ICBM and SLBM launches. Figure 12 shows the history of launches in the second phase of the Soviet LDS program, which began in 1976. Seven of the 12 satellites launched have broken up in orbit [redacted]

59. The Soviets successfully orbited an LDS in April 1980 and another in June 1980, after suffering a failure to orbit one in February 1980. This activity may be an indication that the Soviets believe they have successfully identified and corrected the problems that caused the breakups of earlier LDS spacecraft. The Soviets could establish a network of five satellites in less than one year, which could provide 24-hour coverage of US ICBM sites. A complete network of nine satellites providing some redundant coverage could be available about half a year later. Because we expect continued problems in this program, it may be as late as 1983 before a network providing continuous coverage of US ICBM fields is available. Deployment of an LDS network with coverage of all current and planned US SLBM and ICBM launch areas, probably could not be accomplished before the 1990s.

Figure 12
Lifetimes of Soviet Launch Detection Satellites Launched in Second Phase of the Program



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Manned Military Spacecraft

60. Since 1971, Soviet cosmonauts have periodically occupied two different kinds of Salyut space stations. Salyuts 2, 3, and 5 were primarily military in nature and functioned as intelligence collection platforms, although the Soviets used "scientific research" as a cover for their mission. Salyuts 1 and 4 were primarily for scientific purposes, as is their current Salyut 6, but all have supported military-related R&D programs. For example, both the military and scientific Salyuts have been used for conducting missile launch detection experiments, and these could have some application to development of future military satellites.

61. Both Salyut programs have gained the Soviets some degree of prestige worldwide. In 1979, they set a new man-in-space endurance record of 175 days aboard Salyut 6. (The United States set a manned endurance record of 84 days in 1974 aboard the Skylab space station). Long-term operation of Salyut 6 has been achieved through use of unmanned Progress spacecraft, which are used to resupply the space station with fuel and other expendables. Cosmonauts are shuttled to and from the space station in Soyuz ferry vehicles.

62. The last military Salyut, which was launched in June 1976 and intentionally deorbited in August 1977, carried both low- and high-resolution camera systems.

The space station may also have had a system for transmitting imagery data directly to a ground station.

63. Use of data transmission systems would permit more timely recovery of photographic data than is possible with the Soviet photoreconnaissance satellite systems currently in use. The first opportunity to transmit to Moscow using the standard Soviet space

station orbit would be about eight hours after a photographic session over the United States. The first such opportunity after coverage of NATO countries would be about five to 10 minutes after the pictures were taken. It is doubtful, however, that the film could be processed for transmission that quickly. The Soviets would probably have to wait for the next pass over Moscow, some 90 minutes later.

64. The role of the cosmonauts in the photographic activity is not known. Reasonable roles would include:

- Changing the film.
- Making minor repairs or adjustments.
- Determining cloud cover conditions over areas to be photographed.
- Orienting the space station to center targets to be photographed.
- Accomplishing preliminary interpretation of photography.

65. The Soviets' writings and statements indicate that they intend to increase the frequency, duration, and scope of their manned space flights. They continue to expound on their desire to achieve continuously manned, Earth-orbiting space stations. We believe they have demonstrated the necessary technological requirements for such operations. They have frequently stated an intent to dock multiple Salyut space stations together to form a larger space complex. [redacted]

66. The Soviets have under way a number of developmental activities that will affect their future manned military space capabilities. Such activities have included the following:

- One flight test in 1977 of a new large space station consisting of a large maneuverable segment and a smaller recoverable segment. The total spacecraft [redacted] was about 70 percent the size of a Salyut space station (but apparently equal in mass) [redacted]
- Four flight tests (one failed) of the recoverable segment, [redacted] Each launch (one each year beginning in 1976), orbited two of these spacecraft, which were recovered after only one or two revolutions. [redacted]
- Six flight tests and one manned mission since 1974 of the new Soyuz T cosmonaut ferry vehicle. This new spacecraft is designed to carry a crew of three, as opposed to two for the present configuration of the Soyuz.
- Development of a military "space plane," believed to be part of a Soviet Air Force program. It is a small, delta-wing vehicle incorporating a lifting-body design for horizontal landings on a runway. [redacted] seen in 1976 at the Vladimirovka Advanced Weapons and Research Center, and has been seen [redacted] under the wing of a TU-95 bomber, indicating that drop tests may have taken place. The Soviets probably intend to use their largest currently operational space launch vehicle (SLV), the SL-12/13, to orbit this spacecraft. If the Soviets use the full capacity of this SLV their "space plane" could have a capability to orbit crews of two to six men.
- Refurbishment of two launch sites (estimated completion in 1982) at Tyuratam which previously were used for the Soviets' largest developmental SLV [redacted] Development of this SLV was canceled in about 1974 after several major failures during launch attempts. Nearby, the Soviets are building a new large launch complex, with possibly two launch pads (estimated completion in mid-1980s), which will be serviced by the same vehicle assembly building that services the older sites [redacted] We believe the four launch pads will all be used for a family of new SLVs designed by the Glushko design bureau. We note that the production facility at Kuybyshev, [redacted] may now be responsible for production of the new Glushko launch vehicles. The new SLVs will have considerably more lift capability than that required for

the new small "space plane." We believe that one variant will be capable of lifting a spacecraft comparable in size and weight to the US Shuttle vehicle to near-Earth orbit. A runway, which is to be at least 4,500 meters long, is also being built (estimated completion in early 1980s) near the new launch complex. The runway orientation and size are appropriate for the recovery of manned, reusable spacecraft.

67. [redacted] We have no direct evidence on what specific military or civilian objectives are to be served by these new manned programs. The projections in the following paragraphs are based largely on a logical interpretation of the available evidence and trends.

68. The new space station with the recoverable segment is probably the next generation of military space station, intended to replace the military Salyut. We project that:

— The space station will be launched with three cosmonauts on board, requiring that the Soviets' largest current launch vehicle, the SL-12/13, be man-rated.

— The orbit will probably have a higher inclination to allow photographic coverage of targets not accessible from the current orbits used by Soviet space stations.

— The current resupply vehicle, Progress, will be used for resupplying expendables.

— The new three-man ferry vehicle may be used for crew rotation every five or six months.

— The station could have a lifetime of several years.

— The recoverable segment could be used in case of an emergency or for final crew recovery. Alternatively, the Soviets could send an unmanned ferry vehicle for final crew recovery, with the recoverable segment solely for emergency use.

69. If used in the above manner, the space station could reduce the Soviet need for frequent launches of unmanned photoreconnaissance satellites. And if the space station has the automatic film-processing and imagery data transmission system suspected of having been on Salyut 5, the imagery would be much more timely (hours rather than days) than that provided by the unmanned systems. [redacted] it probably will carry low- and high-resolution cameras, and may carry other sensors—to collect, for example, ELINT and infrared data.

70. The Soviets have conducted three successful tests in which they orbited two of the recoverable segments on each flight. In each case they recovered the spacecraft after one or two orbits, indicating that their primary interest was in testing its reentry characteristics. We have evidence that they may conduct one more such test. We believe that, after they are satisfied with the performance of the recoverable segment, they will orbit and man a prototype of the new space station. This could occur as early as 1980. The mission will be to check out the space station, cameras and other sensors, and the recoverable segment. By the early-to-middle 1980s they could orbit an operational version of the new space station with three men on board, operating in the scenario outlined above.

71. In the early 1980s, the Soviets could use either the old Salyut space station or the new space station to assemble a multisegment space station. Such a station could be used for a variety of missions: for example, one space station segment could contain a complex of reconnaissance sensors, while a second could serve as a laboratory, containing numerous military experiments for developing better sensors and other hardware for unmanned military satellites. The Soviets could also conceivably use such a laboratory for developmental and feasibility testing of small, low-power lasers and of pointing and tracking subsystems. Such efforts could lead to space-based defensive and antisatellite weapon systems in the 1990s and beyond. Use of manned space stations as platforms for such weapons could provide a mission flexibility not available on unmanned systems. Chapter IV discusses this possibility in more detail.

72. The Soviet delta-wing "space plane" is probably a research vehicle that could be developed for military missions. Such missions might include reconnaissance or satellite inspection; or the vehicle might serve as a space weapons platform. The last potential mission is considered less likely because of the estimated limited payload capability. It also could be developed into a crew ferry vehicle to support space station operations. The "space plane" will probably have a crew of two to six men. It seems roughly comparable to, and may have been motivated in part by, the US Dyna Soar program of 1961-63.

73. In examining the scope and magnitude of the present and projected Soviet space effort, we see many reasons for the Soviets to pursue development of a large reusable space transportation system (RSTS). Their motivations would probably include a desire to economize on space launches, particularly in the area of large space station construction, manning and resupply, as well as the general desire to compete with the United States for prestige. The Soviets' efforts on their space plane and the runway at Tyuratam indicate that they may be in the early stages of an RSTS development program. The much smaller "space plane" will probably provide them with valuable experience and data for such a development effort. If flight tests of this vehicle occur in the early-to-middle 1980s, they could begin development of their RSTS in this time frame and conduct orbital test flights by the early 1990s.

Communications Satellites

74. The Soviets currently operate five networks of communication satellite (comsat) systems. Three of these—Molniya 1, Molniya 3, and Statsionar *—use satellites in high-altitude (semisynchronous and geostationary) orbits. These satellites use wideband transponder systems for real-time reception, amplification, and retransmittal of communication signals. The other two comsat systems—which we designate as multiple-payload communication satellites (MPCS), and single-payload communications satellites (SPCS)—use low-altitude orbits. These satellites record Soviet communications for transmittal at a later time (store-dump).

* The Soviets announced plans in the early 1970s for a geostationary comsat network called Statsionar, which is to use 11 orbital positions. To date, five of these positions have been occupied with Raduga, Ekran, and Gorizont satellites.

83. *Future Comsat Systems*

The Soviets have an active program for future geostationary comsat systems. They have stated their intention to establish, by 1982, geostationary comsat networks, which they call Gals, Volna, Luch and Luch-P. We do not know what the Soviets will call the individual satellites that occupy each network position or how many satellites will occupy each position. The frequencies (7 GHz uplink/8 GHz downlink) to be used in their Gals network are internationally recognized as the ones to be used for military comsats. Satellites in the Gals network will have global and regional beams. In addition, the Soviets have indicated that two of these will be equipped with spot beam capabilities directed at regions in the North Atlantic and North Pacific, suggesting naval roles.

84. According to Soviet announcements, the Volna network is to provide communication services to civil aircraft and ships beginning in 1980. The Soviets have indicated that the Volna network is intended to be only a national system and not a competitor of the International Maritime Satellite System (INMARSAT). If the geostationary Volna network is also applied to VIP and military aircraft and naval ships, it could provide greater versatility and reliability than the Statsionar and Molniya networks now being used in a limited role for these purposes.

85. Although, according to the Soviets, both Luch and Luch-P networks are planned for operation in 1981, each appears to have a different mission plan. The Luch network is apparently intended as an international telecommunications system. The Luch-P network on the other hand appears intended for government services.

86. The Soviets are currently five years behind their announced schedule with their Statsionar network, and we see little likelihood of their reaching their planned operational dates for their Gals, Volna, Luch, and Luch-P comsat networks. The completed networks of these systems probably will be available by the mid-1980s. As these systems become available, we expect the Molniya 3 system and, eventually, some

of the current satellites in the Statsionar network to be phased out. The Soviets are expected to retain the Molniya 1 system because of the large investment in related ground communications equipment.

87. By the late 1980s, the Soviets will have the necessary technologies to develop advanced communication satellites, which will be able to achieve data rates of "gigabits" (billions of bits of information) per second. Such satellites will require use of wide bandwidths and high frequencies, and will allow greater user access, highly directional beams, less congestion of the currently used frequency spectrum, and more effective use of spread spectrum signals having low probability of intercept and antijam protection. These advanced systems will not be operationally available before the 1990s. Table 5 summarizes the current and prospective Soviet comsat systems.

Navigation Satellites

88. The Soviets began the development of their NAVSAT systems in the mid-1960s in order to provide their naval forces with accurate and timely navigation signals. Their first-generation system [redacted] was recently phased out of service. The Soviets now appear to be relying on their second- and third-generation systems, which were introduced in late 1974 and late 1976, respectively. These two systems use a better Earth model, [redacted]

89. The second-generation system, which consists of six satellites in near-Earth orbits, [redacted] In 1978 the Soviets announced that a satellite in the third-generation system (four satellites in near-Earth orbit) had the purpose of providing navigation support to their maritime and fishing fleet. All of the satellites in this network appear identical. [redacted]

Table 5

Current and Prospective Soviet Comsat Systems

Satellite Network	No. of Satellites in Network	Orbit	[redacted]
Current:			
Molniya 1	8	Semisynchronous	
Molniya 3	4	Semisynchronous	
Statsionar	11 [a]	Geosynchronous	
MPCS	16-24	1,500-km circular	
SPCS	3	800-km circular	
Future:			
Gals	4 [a]	Geosynchronous	[redacted]
Volna	7 [a]	Geosynchronous	
Luch	4 [a]	Geosynchronous	
Luch-P	4 [a]	Geosynchronous	

[a] These figures reflect the number of geostationary orbital positions as indicated in Soviet filings with the IFRB (International Frequency Registration Board). We do not know how many satellites will actually be used. Currently five of the 11 orbital positions in the Statsionar network are occupied.

[redacted]

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90. We believe the Soviets will continuously maintain their established networks of naval support satellites with replacement satellites as required. Evolutionary improvements to the satellite systems are expected.

91. We also believe there is a moderate chance that the Soviets will elect to develop an advanced navigation system similar to the US Global Positioning System (GPS), which will be continuously available for precision navigation by highly mobile air, ground, and sea-based platforms. The Soviets could elect to incorporate the necessary GPS-type subsystems on their existing high-altitude space systems such as Molniya or a future geosynchronous system such as Volna. They could probably have an operational system available in the late 1980s.

Radar Support

92. The Soviets have been using radar support satellites (RADSATs) since the early 1960s to calibrate their ABM engagement radars, which we call Try Adds, at the Sary Shagan Missile Test Center and at Moscow. In 1974 the Soviets began launching RADSATs which had been designed to support research and development activities

93.

94. We believe the Soviets will continue using RADSATs to calibrate their ABM radars.

Geodetic Satellites

95. In 1968, the Soviets began launching geodetic satellites to determine locations on the Earth's surface precisely. The tracking data can also be used to construct gravitational models which include variances in specific zones.

The Soviets may have also equipped these satellites with laser corner reflectors (as they did on Salyut 4), which could result in errors as small as plus/minus 1 meter. The Soviets may eventually add laser reflectors to some of their other satellite systems; this could eliminate the need for a separate geodetic program.

Meteorological Satellites

96. Soviet "Meteor" satellites are used to collect, on a global basis, information required by meteorologists to describe and forecast weather. The Soviets keep six to 10 of these spacecraft active in orbit during a given year to serve general national as well as military purposes. On a daily basis, three to five satellites are normally active.

97. The Soviets have announced that it is their intention to develop a three-tier meteorological satellite system consisting of a low-altitude manned space station, a medium-altitude satellite system (the current Meteor series), and a system of geostationary satellites. It is clear the Soviets are actively pursuing their manned program and developing sensors appropriate for collecting meteorological data. They are also pursuing development of a geostationary meteorological satellite called the Geostationary Operational Meteorological Satellite. The launch of this system, originally scheduled for 1978 in support of the Global Atmospheric Research Program, has been delayed because of

technical problems with the satellite—it is reportedly scheduled for launch in 1980.

III. CURRENT AND PROSPECTIVE USES OF SPACE SYSTEMS FOR INTELLIGENCE AND MILITARY SUPPORT

98. In this section we consider the ways in which Soviet space systems contribute to military preparations during peacetime and to national decisionmaking and to the conduct of military operations during periods of crises and conflicts.

99. We have not assessed the contributions of Soviet space systems during conflicts involving nuclear strikes within the Soviet Union. All of the Soviet space systems rely on unhardened ground-based facilities for launching additional satellites, tracking and controlling satellites, and for receiving data from, or communicating through, satellites. Nuclear strikes on the Soviet Union could destroy these ground facilities, rendering virtually all of the satellites useless.

100. It is possible that the Soviets could continue to make use of their communications satellites for a short period after their ground-based control sites had been destroyed. Some of these satellites could probably remain viable for several days or even weeks in the absence of command sites to monitor them and could be used by the large number of transportable satellite communications terminals the Soviets have deployed in recent years. Although unhardened, the terminals have some degree of survivability due to their mobility.

101. Table 6 lists the functions to which Soviet space systems would contribute in peacetime, crisis, and conflict. It summarizes the overall capability of Soviet space systems and the degree of Soviet dependence on them for each function. We emphasize that the rankings of capability reflect our assessments of Soviet space systems only and not the total Soviet capability to perform a particular function. In assessing the Soviets' "dependence" on their space systems, primary consideration was given to the availability of nonspace substitutes for the function performed. Three categories of dependence—high, moderate, and low—were used in the assessments. An assessment of high dependence was made when a system performed a function for which there was no practical or satisfactory substitute. When a substitute was available but was not as convenient or did not perform the function as well, the dependence was rated as moderate. Rankings of low dependence were used when the available substitutes were at least equally practical or adequate.

Assessing Technical Characteristics/ Performance of Weapons

102. Analysis of the technical characteristics and performance of weapon systems is primarily a peacetime function since it is generally a long-term effort. In general, the USSR has not emphasized development of satellite collection systems for the purpose of performing detailed weapon system assessments. [redacted] Only their military Salyut space station and second-generation high-resolution photoreconnaissance satellites have cameras with resolutions adequate to contribute to detailed analysis of weapon systems. But they have not flown a military space station since Salyut 5, which was deorbited in August 1977 [redacted]

103. [redacted] In deciding on future space programs the Soviets will almost certainly have to

Table 6

Capabilities of Soviet Space Systems and Soviet Dependence on Them

Functions Supported by Space Systems		Peacetime 1980	Peacetime 1990	Crisis and Limited Conflict 1980	Crisis and Limited Conflict 1990
Detailed technical intelligence analysis	Capability	Poor	Poor-Fair	Poor	Poor-Fair
	Dependence *	Low	Low	Low	Low
Calibrating radars	Capability	Excellent	Excellent	Excellent	Excellent
	Dependence	High	High	High	High
Monitoring compliance with treaties	Capability	Fair	Fair-Good	Fair	Fair-Good
	Dependence	Low-Moderate	Low-Moderate	Low-Moderate	Low-Moderate
Mapping, charting, geodesy	Capability	Excellent	Excellent	Excellent	Excellent
	Dependence	High	High	High	High
Observing and forecasting weather conditions	Capability	Good-Excellent	Excellent	Good-Excellent	Excellent
	Dependence	Low-Moderate	Low-Moderate	High	High
Maintaining order-of-battle and targeting data	Capability	Good	Good-Excellent	Good	Good-Excellent
	Dependence	High	High	High	High
Providing indications and warning	Capability	Fair	Good-Excellent	Fair	Good-Excellent
	Dependence	Low-Moderate	Moderate	Low-Moderate	Moderate
Targeting of antiship weapons	Capability	Not peacetime functions		Fair-Good	Good
	Dependence			Low-Moderate	High
Navigation support to naval combatants	Capability	Excellent	Excellent	Excellent	Excellent
	Dependence	Low	Low	Moderate	High
Military command and control communications	Capability	Good	Excellent	Good	Excellent
	Dependence	Low-Moderate	Moderate	Low-Moderate	Moderate

* Dependence: High (no practical or satisfactory substitute).
Moderate (substitutes available but are not as convenient or do not perform mission as well).
Low (substitutes available that are at least equally practical or adequate).

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balance the payoff between improvements to current systems and the costly development of new systems against the availability of information from other sources.

104. Thus, we rate as poor the overall capability of current Soviet space systems to provide technical data on weapon systems, but we judge current Soviet dependence on satellite systems for such use to be low. By 1990 the resolution of Soviet photoreconnaissance satellites will give them a good-to-excellent capability for the weapons assessment function, but for this purpose the expected improvements in the Soviets' ELINT and infrared satellite systems probably will not significantly increase their current capability. And we do not project Soviet satellite systems dedicated to telemetry or communications intercept before the late 1980s. Throughout the 1980s the overall Soviet capability for weapon assessments will probably remain relatively poor. We expect Soviet dependence on satellite systems for this function to remain low, primarily because of the availability of information from other sources.

Calibration of ABM Radars

105.

Because there is no other practical way for them to accomplish this task, the Soviets are highly dependent on these satellites and will remain so. We rate overall RADSAT capability for this purpose as excellent.

Monitoring Compliance With Treaties and Agreements

106. There are many provisions in current and prospective treaties and agreements that require monitoring to determine compliance. Soviet space systems contribute to monitoring many of the provisions of current and prospective arms limitations agreements. For example:

Interim Agreement Limiting Strategic Offensive Arms

— Prohibits construction of additional ICBM launchers.

— Limits the number of SLBM launchers.

— Limits the number of modern ballistic missile submarines.

SALT II Agreement

— Places aggregrate limits on ICBMs, SLBMs, and strategic cruise missiles.

— Places qualitative limits on strategic missiles.

ABM Treaty

— Limits ABM deployment areas.

— Limits number of ABM launchers.

— Limits power-aperture product of certain phased-array radars.

Outer Space Treaty

— Prohibits placing in orbit objects carrying nuclear weapons or any other kind of weapons of mass destruction.

Limited Test Ban Treaty

— Prohibits nuclear explosions in the atmosphere, in outer space, and under water.

Seabed Arms Control Treaty

— Prohibits deployment of nuclear weapons and any other weapons of mass destruction on seabeds and the ocean floor beyond the 12-mile limit.

107. Foreign activities in all the above areas, as well as in virtually all the numerous other provisions in treaties and agreements, were important to the Soviets and were the object of Soviet intelligence collection before the establishment of formal limitations and prohibitions. The Soviets' photographic and ELINT satellite reconnaissance systems can provide them with data useful in monitoring compliance with provisions that limit fixed weapon and radar systems to certain numbers or certain areas, or both. These satellites are in general not adequate for monitoring compliance with qualitative limitations on strategic weapons. The agreements themselves have not likely stimulated any major new Soviet requirements for space systems. To the extent that the Soviets rely on space systems for the compliance monitoring function, the monitoring requirement would exist during crisis and limited conflict, as well as in peacetime. Clearly, in a crisis and limited conflict situation the priority for monitoring certain arms limitations agreements would be reduced by the competing demands for indications and warning (I&W) and order-of-battle data.

108. On the basis of the capabilities and limitations discussed in section II and of the wide range of required compliance monitoring tasks, we rate as fair the current Soviet satellite capability for this mission. This rating could improve somewhat with the launch of the USSR's next manned military space station, depending on the number and type of sensors it carries. Soviet development of real-time imaging and high-altitude ELINT satellite systems in the late 1980s, as discussed in section II, could increase the USSR's capability from fair to good for this compliance monitoring task.

109. We judge Soviet overall dependence on satellite systems for this monitoring task to be low to moderate. Satellite data are probably of value to the Soviets primarily for confirming compliance monitoring information obtained from nonsatellite sources. Considering the continued availability to the Soviets of nonsatellite information, we do not expect a significant change in their dependence on satellite systems to monitor the types of arms limitation agreements currently in effect.

Mapping, Charting, Geodesy

110. Accurate maps, charts, and Earth gravitational models are required for a variety of military missions, including the precise targeting of ballistic missiles. The collection and analysis of necessary data call for a long-term effort, which is considered a peacetime function.

111. Like the United States, the USSR has become highly dependent on satellite systems to support its mapping, charting, and geodetic efforts. All of the Soviets' photoreconnaissance satellites supply photography useful to mapmakers. Their photographic-geophysical spacecraft, in particular, appear to collect basic mapping and geophysical data on worldwide ocean and land surfaces. In addition to a low-resolution camera system, these satellites also [redacted] may be used to determine ocean temperature gradients and currents. The Soviets' geodetic satellites are used to collect data in support of their efforts in geodesy and gravimetry. The data collected allow the establishment of an accurate geodetic grid of the Earth's surface, and thereby reduce errors in the delivery of some weapons.

112. We rate as excellent the overall capability of Soviet satellite systems to collect required data for mapping, charting, and geodesy. Satellites are the only practical means available to collect such data worldwide. The Soviets have been collecting these data for more than 15 years, and the collection and analytical results are, to some degree, cumulative. However, the fact they continue to launch satellites for collection of such data shows they want to refine what they already have available. We expect continued use of satellites for these purposes through the 1980s and, therefore, continued high dependence.

Observing and Forecasting Weather Conditions

113. Knowing and being able to forecast weather conditions is important to support a variety of military activities, including the scheduling and routing of aircraft and ships; planning and executing force movements; planning exercises; scheduling tests that involve use of equipment sensitive to weather conditions, such as optical devices and lasers; planning for spacecraft recovery operations; and selection of cloud-free target areas for photoreconnaissance satellites. In addition, if the Soviets attempt to use their launch detection satellites to collect technical infrared data on foreign ballistic missile launches, weather information during the missile launch could be an important consideration for proper interpretation of the infrared data.

114. The Soviet meteorological satellites clearly are used in support of a wide variety of military activities in addition to being used for observing and forecasting weather conditions for civil purposes. Additional data on weather over Soviet territory and peripheral areas are provided by ground sensors, balloons, and aerial reconnaissance. During peacetime, moreover, worldwide weather data are exchanged by the developed countries. Generally, however, this information is less useful than Soviet-acquired data for open ocean and underdeveloped areas and is not always timely.

115. We rate as good to excellent the current overall capability of the Soviets' meteorological satellite system. We believe their capability will be somewhat improved in the early 1980s with the advent of a geosynchronous meteorological satellite system. Their dependence on satellite systems for meteorological purposes during peacetime is judged to be in the low-to-moderate range. We believe that their dependence would increase to high during any conflict situation that halted the worldwide weather exchange.

Maintaining Order of Battle and Targeting Data

116. Effective targeting of offensive weapon systems requires maintenance of targeting data on important foreign fixed military installations (missile silos/shelters, airfields, ports, bases, nuclear storage sites, command and control bunkers, etc.), industrial facilities (weapon production plants, oil refineries, steel mills, etc.), and other facilities essential to waging and surviving nuclear warfare. These are all large, fixed installations and facilities, and new ones require years to build. Maintaining this targeting data is a continuous peacetime function as well as a function performed during crisis and conflict situations.

117. A similar function is the maintenance of orders of battle on the location, number, type, and status of foreign land- and sea-based weapons and forces of all types as part of the process of assessing the capabilities of foreign military forces. Many of the relevant items (such as surface-to-air missile systems, aircraft, ships, radar systems, and forces) are mobile, and their location and status require frequent updating. Maintaining orders of battle in peacetime, crises, and conflicts is necessary for both targeting and contingency battle management planning purposes.

118. Table 7 is a listing of major systems on which the Soviets almost certainly keep current orders of battle, and the satellite systems that aid them in this effort. Their photoreconnaissance satellites provide valuable order-of-battle information on land-based systems and forces. These satellites are particularly useful against those systems that do not use radars, or use radar frequencies outside the coverage of Soviet ELINT satellites, or practice emission control. The Soviets' low-resolution photoreconnaissance system, which appears to have been phased out, performed the search mission, but its resolution was insufficient to identify the types and status of relatively small weapons and military equipment. For such identification, the medium-resolution system, which may be assuming the search function, is probably adequate, and the high-resolution systems certainly are adequate. The Soviet military space station of the early-to-middle 1980s, which will almost certainly carry both low- and high-resolution cameras, also will add to the Soviet search and identification capability.

119. The Soviets' ELINT satellites can provide order-of-battle data on land- and sea-based radar systems, even those that have been camouflaged or concealed from the view of photoreconnaissance satel-

Table 7

Summary of Soviet Satellite Uses for Collecting Order-of-Battle Information

	Photographic Satellites			ELINT Satellites		Radar Satellites	
	Low-Resolution	Medium-Resolution	High-Resolution	Second-Generation	Third-Generation	EORSAT	RORSAT
Surface-to-air missile systems							
Monitor radar enviornment	–	–	–	X	X	–	–
Locate new deployment	X	X	–	–	X	–	–
Identify system	–	–	X	–	X	–	–
Determine status at known locations	–	X	X	–	–	–	–
Early warning/ground-controlled-intercept radars							
Monitor radar environment	–	–	–	X	X	–	–
Locate new deployment	X	X	–	–	X	–	–
Identify system	–	–	X	–	X	–	–
Determine status at known locations	–	X	X	–	–	–	–
Aircraft							
Determine numbers at airfields	X	X	X	–	–	–	–
Determine types of airfields	–	X	X	–	–	–	–
Identify armaments	–	–	X	–	–	–	–
Ballistic missiles							
Locate new deployment	X	X	–	–	–	–	–
Identify system	–	X	X	–	–	–	
Determine status at known locations	X	X	X	–	–	–	–
Surface ships (combatants)							
Determine numbers in port and identify	X	X	X	–	–	–	–
Locate at sea	–	–	–	–	X	X	X
Identify radar types	–	–	–	X	X	X	–
Monitor radar environment	–	–	–	X	X	X	–
Submarines							
Determine numbers and types in port	X	X	X	–	–	–	–
Ground forces							
Locate	X	X	–	–	X	–	–
Determine composition	–	–	X	–	X	–	–
Determine status	–	X	X	X	X	–	–

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lites or are mobile. Their second-generation ELINT satellite system provides useful data for determining the status of radar systems. Their third-generation ELINT system adds to knowledge of status and also provides location of active radars. The measurements of radar signal parameters made by these satellites are, in general, adequate to define radar type.

120. On the basis of the capabilities and limitations of these satellite systems as discussed in section II, we rate as good their current overall capability in peacetime. When the Soviet radar and ELINT ocean reconnaissance satellites become fully operational in the early 1980s, we believe the capability will improve somewhat to between good and excellent. Development of real-time imaging systems in the late 1980s and high-altitude ELINT collection systems in the mid-1980s could add significantly to the timeliness of information and somewhat increase Soviet capability.

121. We believe the Soviets are highly dependent on their satellite systems for maintenance of targeting lists and orders of battle. In denied areas such as China and for mobile forces such as ships, there is no other way to acquire the required large amounts of information on a frequent basis.

Providing Indications and Warning

122. Providing indications of foreign preparations for attack on the USSR or its allies and providing warning that an attack has been launched are almost certainly the functions of highest priority for all Soviet collectors of information. The indications and warning (I&W) function is essential during peacetime to prevent an enemy from obtaining the advantage of surprise. During periods of crisis and limited conflict, I&W information is required to provide strategic warning of the imminence of hostilities or escalation of a conflict and to provide tactical warning of an attack in progress. Timely, reliable I&W information allows decisionmakers to take appropriate action, ranging from increasing the readiness of forces to invoking contingency plans, such as launching a preemptive attack or launching an attack upon receipt of a tactical warning.

123. Information from satellite systems would almost certainly be combined with information from other sources as a basis for action by decisionmakers. We doubt that the Soviets would become completely dependent on satellite systems for I&W information. Optimum satellite systems for I&W would be those that could perform continuous worldwide surveillance and pass data in real time to a central I&W authority. None of the Soviet systems qualify on both counts, but several have the potential to contribute I&W information:

- Soviet photoreconnaissance satellites can provide useful information on force status within their coverage.
- The Soviets' ELINT reconnaissance satellites are capable of contributing to the determination of force disposition and composition.
- When operational, probably by the mid-1980s, the Soviets' launch detection satellite (LDS) system will provide them with about 30 minutes' warning of the launch of US ICBMs.
- The Soviets' radar and ELINT ocean reconnaissance satellites will, when fully operational in the early 1980s, provide them the capability to report ship movements within their coverage in real time to Soviet ships in the vicinity, and will also be able to store the data for later transmission to Moscow.
- The Soviets' manned military space station may carry a photoreconnaissance system in which the film is automatically processed for transmission to Moscow within hours. Cosmonauts could conceivably perform preliminary analysis of photography and other sensor data for specific purposes of I&W. These observations could be relayed instantaneously to Moscow if relay satellites or ships with comsat relay capabilities are used.
- If the Soviets develop satellites capable of collecting COMINT by the late 1980s, such satellites could also be used to provide indications and warning.

124. The data from these individual Soviet space systems in combination with other information is used by the Soviet General Staff in producing I&W assessments.

125. On the basis of the individual satellite system capabilities and limitations discussed in section II, we rate as only fair their current overall capability to contribute to the Soviets' I&W task. The launch detection satellites, radar and ELINT ocean reconnaissance satellites, and military space stations will add to their capabilities, so that by the early-to-middle 1980s their capability will be fair to good. Development of the real-time imaging and high-altitude ELINT collection systems and expansion of their launch detection system capabilities, as discussed in section II, would add significantly to the Soviets' capabilities and could result in good-to-excellent capability by the late 1980s or early 1990s. We believe Soviet dependence on satellite systems for the I&W function is currently low to moderate, but may increase somewhat by the late 1980s.

Targeting of Antiship Weapons

126. The use of satellite-derived data to target antiship weapons is primarily a combat function, but such data are used in peacetime for test and training purposes and to contribute to ocean reconnaissance. The Soviets have deployed antiship cruise missiles on long-range aircraft, surface ships, and submarines. They seek to employ such weapons from beyond the target's visual/radio horizon so that the launch platform can stand off as far as possible to avoid detection, achieve surprise, and avoid countermeasures. For over-the-horizon attacks, antiship cruise missiles require accurate, timely, and unambiguous targeting data. In supplying data directly to a cruise missile platform, satellites effectively become part of the weapon system. In part for this purpose, the Soviets have developed their two ocean reconnaissance satellites—RORSAT and EORSAT—to supply sea-based missile platforms with such data in real time. We have no evidence that they have equipped airborne cruise missile platforms to receive such data from satellites.

127. In a combat engagement, Soviet ships and submarines with long-range antiship cruise missiles (such as the SS-N-3A and SS-N-12) would establish approximate enemy force location, disposition, and identification by means such as reconnaissance aircraft, tattletale ships, radio direction finding, or human sources. Accurate final position information would then be provided in real time by EORSAT, or RORSAT, or a nonspace system. Once launched, the cruise missile would maintain line of sight to the launch platform until the target had been selected and the lockon/dive initiated.

128. Because of the limited swath widths, the small numbers of satellites and limited numbers of ships equipped to receive their data in real time, and susceptibility to countermeasures, the EORSAT and RORSAT do not currently add significantly to the threat posed to naval forces operating in broad ocean areas. These satellites would contribute significantly, however, to the threat posed against large ships operating in the confined waters of the ocean approaches to the Soviet Union (as in the Northwest Pacific and the Norwegian and Barents Seas). This is primarily due to satellite orbital geometry, which results in frequent access to these areas. The access to other potentially critical areas, such as the Mediterranean Sea, Persian Gulf, and Indian Ocean is much less frequent.

130. In addition to equipping more combatants to receive targeting data, the Soviets are expected to make future improvements in the satellites and in the operational use of these space systems. Both the EORSAT and RORSAT initially supported the Soviet Navy in its defense of the open-ocean approaches to the Soviet Union. However, with Soviet naval presence in the Indian Ocean increasing and the general trend

toward global operations, we believe the Soviets will expand the coverage provided by their ocean reconnaissance satellites. By launching additional satellites, the Soviets could increase their coverage at the low and middle latitudes and substantially improve timeliness (revisit times) at the higher latitudes. The rapid launch capability of the booster (same as orbital interceptor) used to orbit the EORSAT and RORSAT could allow the Soviets to exercise this option during periods of increased tension.

131. On the basis of the capabilities and limitations discussed in section II, we assess as fair to good the capability of the current EORSAT and RORSAT to assist in targeting antiship cruise missiles during periods of crisis or limited conflict. During the period of this Estimate, we expect that improvements in these satellites and the method of system deployment will improve this capability to good during periods of crisis or limited conflict. Currently, the Soviets can use Bear D aircraft and Hormone helicopters for over-the-horizon targeting of antiship cruise missiles. In areas distant from the USSR, however, the Soviets are more dependent on satellites for these purposes. We judge that, overall, Soviet dependence on satellites for targeting of cruise missiles is currently low to moderate. In the future, as the areas of Soviet naval operations extend farther from the USSR, we expect Soviet dependence on satellites for this function to increase, reaching a high level in the late 1980s.

Navigation Support to Naval Combatants

132. Accurate navigational data are required by a broad range of naval combatants, particularly submarines equipped with ballistic missiles. Satellites can supply such data almost anywhere in the world with little or no restrictions due to weather, lighting, or ionospheric conditions. The provision of such data is required in peacetime, as well as in a crisis or wartime.

136. We rate as excellent the overall capability of Soviet satellites to provide accurate and timely position-fix data to naval combatants. Inasmuch as other navigational systems (such as celestial navigation, bottom contour navigation, and radio navigation systems) are available to their ballistic missile submarines, the Soviets' dependence on NAVSATs is considered low during periods of peacetime and crisis. In conflict situations, the substitutes for satellite navigation would not be as convenient and in some cases not as reliable as satellite means of navigation. Thus, we rate the Soviets' dependence in conflict as moderate. Increased accuracy requirements for their submarine-launched ballistic missiles in the late 1980s could increase their dependence during wartime to a high level. This would be particularly true if the accuracy of position fixes provided by their satellites is substantially better than that provided by other navigation aids.

Military Command and Control Communications

137. The command and control of strategic and conventional forces is a critical function that must be performed under the full range of conditions from peacetime through general nuclear war. Like the

United States, the USSR has recognized the significant contributions and values of communications satellites for this function.

138. Command and control communications via satellites began to be used by the Soviet military establishment in the late 1960s. Since then, the Soviets have generally developed comsat capabilities as a redundant means to communicate with their military commands. The expansion in comsat users has been evolutionary, with priority given to high-level commands, particularly those associated with nuclear-capable forces. In recent years we have witnessed a large growth in the number of mobile terminals, including airborne and train-borne command posts. Additionally, two large command and control surface ships have been equipped to use high-altitude comsats, Thus, Soviet use of comsats has evolved from incountry operations to supporting high-level Soviet leaders, naval combatants, and military advisory groups in areas quite distant from the Soviet landmass.

139. Communications satellites offer the Soviets several advantages over landlines and radio communications. Soviet comsats now handle the large volumes of information needed for modern battle management. The large capacity of satellite links and the use of mobile terminals also offer increased centralization and flexibility in the command and control of a variety of forces. While the capacity of their individual satellites is small in comparison with US comsats, the Soviets could augment their total capability by converting all of their comsats to military use in a wartime or crisis situation. They have recently demonstrated many advances that increase the security and capacity of their satellite communications. Soviet comsats suffer from relatively short lifetimes, with few exceeding two years.

140. We expect that in the 1980s the Soviets will begin to deploy geosynchronous comsats using higher frequencies, with increased capacity and improved lifetimes. However, we do not expect the Soviets will achieve all of the target dates they have announced for their future comsat systems (the Gals network, for example, was scheduled for operation in July 1979, but is still not in operation). When they have successfully deployed the Gals, Luch-P, and Volna networks, we expect that they will phase out the Molniya 3 and possibly some of the Statsionar comsats. When their announced programs are completed in the mid-1980s, it is likely that access to reliable, high-capacity satellites will be extended on a global basis to a greater variety of ground force, airborne, and naval users.

141. The demonstrated usage and improvements seen in the late 1970s cause us to rate as good the overall capability of current Soviet high-altitude comsats to support forces and personnel deployed anywhere in the world. We expect this capability to be excellent by the mid-1980s. Because of the currently available redundant means of military communications, we assess the USSR's current dependence on comsats as low to moderate. By the mid-1980s, the expected growth in comsat usage and capacity will result in increased dependence by the military. This will be the case especially if automated data support systems for command and control are put into use as we anticipate, because the Soviets will be unable to maintain redundant ground-based systems with the capabilities (high capacity) expected in future satellite systems. Therefore, we expect their dependence on high-altitude comsats will increase to a moderate level.

Summary of Crisis and Conflict Management Capabilities

142. The previous sections point out that space systems make an important contribution to the Soviets' overall capability to manage crisis and conflict situations. The type of information required for effective, timely decisionmaking in a crisis or limited conflict could be political, economic, military, or all three, depending on the situation. Soviet satellite systems in general can aid in fulfilling all of these requirements. Data collected by satellites allow military assessments and provide information such as the location, disposition, composition, and status of land- and sea-based forces and of weather conditions. The value and utility of the information for managing a crisis or local conflict are primarily a function of its timeliness relative to the pace at which the situation is changing.

143. The Soviets have used photoreconnaissance satellites intensively to aid the crisis and conflict monitoring task, by launching a number of satellites quickly and recovering the film in about half the usual time. They now have the capability to deorbit capsules from their second-generation high-resolution system as requirements dictate. The next manned military space station may provide the capability to transmit imagery to Moscow within a matter of hours after photographic

sessions. We believe, however, that they will continue to place reliance on unmanned photoreconnaissance satellites, which can be launched at appropriate times to ensure suitable lighting conditions in target areas. Projected Soviet development of a near-real-time sun-synchronous imagery system in the late 1980s would greatly increase the timeliness of photographic information.

144. The Soviet second- and third-generation ELINT satellite systems provide access to worldwide land and sea areas, with data delay times measured in hours. They can pass the ELINT data to Soviet ground sites within hours (sometimes minutes) of being collected. Projected development of a high-altitude ELINT collector for use in the late 1980s would add significantly to their capabilities. Such a system could be designed to have continuous access to large areas and pass collected data in real time.

145. Soviet radar and ELINT ocean reconnaissance satellites (RORSATs and EORSATs) have the capability to report data in real time to Soviet ships in the vicinity in addition to recording the locations of foreign ships in crisis or conflict areas for later (measured in hours and sometimes minutes) transmission to Moscow. Their current access to areas within their coverage ranges from minutes to days. The access to areas at high latitudes (such as the Norwegian and Barents Seas) is excellent, while access to areas near the equator is poor. The Soviets could improve the access timeliness by launching multiple satellites into orbits having different planes. Analysis of the use of their EORSATs, RORSATs, and ELINT satellites in past crisis, conflicts, and exercises simulating conflicts indicates that the Soviets coordinate individual collector tasking to make the most efficient use of satellite systems capabilities and ground control sites.

146. The timeliness of the worldwide meteorological information provided by Soviet Meteor satellites varies from near-real time to hours, depending on the area. The expected launch and operation of a geosynchronous meteorological satellite in the early 1980s could provide real-time information over a large area of the world (nearly one-third of the Earth is visible from geosynchronous orbit).

147. The USSR's naval support satellites can provide navigation data to its naval forces in the vicinity of a crisis or conflict. Their access time is measured in hours.

148. Soviet communications satellites can be used to relay all types of information to and from the affected areas—such as communications with Soviet agents, advisory groups, and military forces. This in turn is affected by whether the crisis or conflict area is within the view of the Soviets' high-altitude comsats, which serve as real-time relays, or only within that of their low-altitude "store/dump" comsats, which have timeliness measured in hours.

149. The Soviet launch detection satellites, when operational in the early 1980s, will provide the Soviets with continuous coverage of US ICBM fields for real-time warning that a crisis or conflict has escalated to the point that ICBMs have been launched.

150. On the basis of the capabilities and limitations of the Soviet satellite systems, we rate their current overall capability for crisis and limited conflict as fair to good. With expected increases in the operational availability of their radar and ELINT reconnaissance satellites and launch detection satellites in the early-to-middle 1980s, the Soviets' capability will improve to good. They could further improve their capability to good-to-excellent in the late 1980s with the introduction of a near-real-time imaging system and a high-altitude ELINT collection system.

151. We believe the Soviet dependence on satellite systems for crisis and limited conflict management to be moderate at present. By the late 1980s, we believe they may be highly dependent on satellite systems to monitor crisis and conflict situations. Soviet space systems, however, are dependent on a command and control infrastructure that is highly vulnerable, and therefore Soviet capabilities in a general nuclear conflict could be much reduced.

IV. CURRENT AND PROSPECTIVE USE OF SPACE SYSTEMS TO NEGATE THOSE OF OTHER NATIONS

152. This section addresses the evolution of Soviet attitudes toward foreign space activities, current and prospective spaceborne antisatellite (ASAT) systems, Soviet knowledge of foreign space systems, the USSR's dependence on its own space systems, and the likelihood of spaceborne ASAT use under differing world stress conditions. This discussion is limited to *spaceborne* antisatellite systems, whereas other interagency products address the full spectrum of Soviet antisatellite capabilities (both spaceborne and ground-based) and prospects for their use.

Soviet Attitudes Toward Space

153. At the beginning of the space era, Soviet authorities viewed space as an arena of East-West competition in peacetime and as a potential combat arena in wartime. In the early 1960s, Soviet media expressed concern about the potential US deployment of weapons in space, particularly orbital nuclear weapons. In 1963, the revised second edition of a key Soviet publication, "Military Strategy," contained admonitions about the need for defenses against a wide variety of satellite systems, including satellites used for reconnaissance, communications, navigation, and bombardment.

154. Over the years the Soviets' attitude toward foreign space operations has gradually changed from one of general hostility to one of qualified acceptance. Their record, however, has left some important areas of doubt as to the extent of their acceptance of certain uses of space as legitimate, especially with respect to space reconnaissance not related to treaty verification. Tolerance of space systems used for purposes such as reconnaissance, communications, navigation, and other military support functions became evident in the mid-1960s as the Soviets themselves began to employ such systems. The SALT I negotiating process from 1969 to 1972 culminated in the ABM Treaty and the Interim Agreement on Strategic Offensive Weapons, both of which acknowledge that both sides will use "national technical means (NTM) of verification." The Soviets stated that NTM included satellite systems, but the United States and the USSR have not attempted to identify which specific space systems are included. Soviet negotiators insisted on qualifying the agreement to use national technical means of verification with the phrase "in a manner consistent with generally recognized principles of international law." The agreements did not codify, however, nor did the Soviets specify in the negotiations, the uses of national means of verification that they would regard as consistent with principles of international law.

155. The Soviets still hold that certain space activities cannot be accepted as legitimate. For example, they have claimed a unilateral right to take active countermeasures against satellites for direct broadcasting to populations without the agreement of the target state's government. They hold that such broadcasting would be an illegal, hostile intrusion upon a state's sovereignty. In ASAT treaty negotiations Soviet representatives maintained that space systems that violate Soviet air space or territory, damage the environment, or violate a state's sovereignty in other ways such as direct broadcasting are hostile or illegal actions and should be excluded from the treaty's protection.

156. The Soviets' general acceptance over the years of most space activities has in large measure been due to their recognition that space is an increasingly attractive medium for them to accomplish crucial military-support functions, including reconnaissance, command and control communications, and navigational assistance. They appear to see substantial advantage in maintaining the benign environment in which space activities have been conducted for nearly two decades and from which they have reaped political, military, scientific, technological, and economic benefits.

157. It is also clear, however, that they recognize the importance the West places on satellite systems for supporting military activities. The Soviets' development of an antisatellite orbital interceptor system and their more recent efforts to modify it and to develop more advanced systems clearly show a desire to have the capability to negate foreign satellites, should the decisions be made that such action was necessary.

158. Overall, our assessment of the Soviets' attitudes and policies toward space activity suggests that some of their decisions on interference in space would not necessarily depend upon prior diplomatic undertakings. At least at higher levels of international stress, decisions on whether to interfere with US satellites would depend on Soviet political and military interests, Soviet capabilities, and the expected consequences of given actions.

Current and Prospective Spaceborne ASAT Systems

159. *Orbital Interceptor.* The Soviets have had an operational, nonnuclear orbital interceptor system since the early 1970s. This system can be used to intercept and destroy foreign satellites having orbital inclinations between about 40 degrees and 140 degrees. They have demonstrated successful engagements at altitudes ranging from about 160 to 1,600 kilometers. The system is probably capable of attacking satellites at altitudes up to about 3,800 to 8,700 km, depending upon the characteristics ascribed the interceptor and the orbital inclination of the target. The system uses ground-based target-tracking radars to establish a projected intercept point, two launch pads

at the Tyuratam Missile Test Range, and a ground control facility near Moscow. None of these ground facilities are hardened against nuclear detonations, indicating an intention to use the system before nuclear strikes on the Soviet Union.

160. The operational orbital interceptor uses an onboard radar sensor during the terminal portion of the engagement [redacted] The Soviets have successfully demonstrated both one- and two-revolution intercepts. The two-revolution intercept profile requires about 195 minutes to complete the engagement [redacted] one-revolution intercept profile [redacted] the time required for engagement is reduced to about 95 minutes, thereby reducing the amount of time available to the enemy to deduce that an attack is under way and to employ evasive maneuvers or other countermeasures to prevent satellite destruction. Because the Soviet interceptor itself is destroyed when the warhead is exploded to create the fragments that destroy the target, a separate interceptor must be launched against each target.

161. We do not know whether the Soviets routinely maintain orbital interceptors in a ready status within the Tyuratam support facilities. We believe they would do so in periods of crisis or limited conflict that they perceived might escalate to major confrontations. We believe that two orbital interceptors, if maintained in a ready status, could be moved from the support areas and launched within one or two hours of a decision to do so. And the minimum time between launches from the same launch pad may be as little as two to three hours. The support facilities could accommodate 10 to 12 launch vehicles with interceptors attached. A new building, under construction since mid-1978, could double the site's storage capacity for ASAT interceptors and boosters. However, all of these support facilities and the two launch pads are also used for Soviet radar and ELINT ocean reconnaissance satellites, making it unlikely that they would be devoted entirely to orbital interceptors.

162. The orbital interceptor system presents a significant threat to satellites using the near-Earth orbits characteristic of most US intelligence and many other military support systems. [redacted] We believe that the Soviets consider those satellites that provide intelligence or direct support (such as navigation) as the targets of highest priority.

163. The orbital interceptor has no capability against satellite systems in semisynchronous or geosynchronous orbit. Geosynchronous satellites are too high, and satellites in highly elliptical semisynchronous orbits pass through the interceptor's engagement altitudes at velocities too high for the interceptor to engage successfully. [redacted]

164. The operational version of the orbital interceptor has been tested 13 times against targets since 1968. Although five of these tests were failures, we believe that subsequent tests achieved the desired objectives. Between December 1976 and May 1978, the Soviets conducted three tests of a developmental orbital interceptor [redacted] None of the targets were damaged in any of the tests. A fourth test of the developmental orbital interceptor occurred in April 1980 after a standdown of nearly two years. The test was an unsuccessful two-revolution attempt using the developmental version of the interceptor. The Soviet decision to resume testing after a standdown of nearly two years probably reflects a pressing technical need to renew testing of the troubled developmental interceptor (ASAT) system. If the Soviets were refraining from

testing for political as opposed to technical reasons, it now appears that they no longer feel constrained.

165. Unless the United States and the USSR agree to prohibit testing of antisatellite systems, we believe the Soviets will continue their testing activities and will stress the successful completion of their developmental orbital interceptor system using the new acquisition and homing sensor. We also believe that there is about an even chance that the Soviets would, after appropriate modifications, mate their orbital interceptor to a larger booster and test it against semisynchronous and geosynchronous target satellites. During the 1980s and 1990s, the Soviets likely will supplement the existing orbital interceptor and any other antisatellite system with new antisatellite systems—such as a dedicated direct-ascent interceptor or space-based lasers.

166. ***Space-Based Laser.*** There is evidence of a Soviet project to develop a space-based laser weapon that we believe may have an antisatellite application. Such a system would have significant advantages over the orbital interceptor in that it would have multishot and long-range capabilities, perhaps on the order of 1,000 km between weapon and target. It is also likely to have a greater capacity to overcome defensive measures, such as maneuvering and decoy deployment. Development of such a complicated satellite is technically difficult, and we are uncertain as to the approach the Soviets will take. They could forgo space tests with a smaller system and launch a 5-MW system, although this would be technically risky. They could have a prototype system for antisatellite testing by the late 1980s. They might first launch a laser system of somewhat lower power—several hundred kilowatts—but not before the mid-1980s. Another possible development program would initially call for an in-space feasibility demonstration using an even lower power laser—in the approximate range of 25 to 75 kW—as a test bed. If such a test bed could fit into an existing spacecraft, it might be launched in the early-to-middle 1980s.

167. *Space-Based Particle-Beam Weapons.* There are serious questions concerning the feasibility of space-based particle-beam weapons (PBWs). Critical technologies for the development of a space-based PBW are: space-qualified neutral-beam particle accelerators, precise pointing and tracking subsystems with submicroradian precision, and high-power, lightweight power supplies. The Soviets have broadly based research programs that are related to particle beam weapons development. These technologies, however, are in an early development stage and it would probably be the early-to-middle 1990s before they could test the practicality of a space-based PBW weapon.

168. ***Radiofrequency-Damage Weapons.*** The Soviets have been working on novel, high-power sources of radiofrequency radiation or electromagnetic pulse that could damage by destroying electronics or other spacecraft parts. By the early 1980s they could have this technology available for subsequent use on a spacecraft. However, we believe there is a low likelihood the Soviets will elect, within the next decade, to develop a space-based radiofrequency-damage antisatellite weapon, in part because a ground-based weapon would be less complex and probably more effective and in part because their current efforts appear to emphasize laser weapon systems.

169. ***Manned Space Systems.*** We believe, as stated earlier, that the Soviets are pursuing the development of manned reusable space systems that have potential ASAT applications. The Soviets have voiced concerns, in the negotiations to limit ASAT activities, about the potential use of the US Shuttle in an ASAT role, such as altering spacecraft orbits. These concerns could be based on their knowledge of the capabilities of the US Shuttle or on their own future mission plans.

170. It is conceivable that the Soviets might use their manned space stations to conduct feasibility testing of low-power laser systems and associated subsystems in the early 1980s. Having cosmonauts available for minor repairs and adjustments may be perceived as a way of ensuring steady progress and overcoming the many problems they have had in introducing unmanned, complex spacecraft like their RORSATs, EORSATs, and launch detection satellites. The Soviet goal of having continuously manned space stations may include such testing activities among its objectives, and might even include having such weapon systems as operational elements of future space stations for both defensive and offensive purposes. Operational, high-power (5 MW) versions of such weapon systems probably would not be available before the 1990s. However, we have no direct evidence that the Soviets are developing an antisatellite capability for their manned spacecraft.

Soviet Knowledge of Foreign Space Systems

171. A prerequisite of intelligent use of a spaceborne antisatellite system is, of course, identification of

those foreign satellite systems to be engaged. At any one time, there are well over 100 non-Soviet satellites active. We believe the Soviets' knowledge of all near-Earth and most high-altitude spacecraft is sufficient for identification and targeting purposes. Their knowledge is based on:

- A large number of authoritative, unclassified documents such as Congressional records and reports, and a wide variety of technical journals.
- Human sources.
- Information gathered from a sophisticated network of land- and sea-based SIGINT collectors, both conventional and covert.
- Orbit determination by their space surveillance network.

172. We do not know the full extent of Soviet knowledge of foreign space systems. Unclassified Soviet literature indicates a broad and, on occasion, detailed understanding.

Soviet Dependence on Space Systems and Their Vulnerabilities

173. Any decision by the Soviets to interfere with or destroy a foreign satellite system would almost certainly be based in part on an evaluation of their own dependence on space systems and the vulnerability of the space systems to foreign antisatellite means. Their dependence on satellite systems for military support functions was discussed in section III and summarized in table 6 (following paragraph 101). Our estimates of their dependence range from low to high for specific functions, depending mainly on the availability of nonsatellite means to fulfill those functions. In general, their dependence will probably increase in the 1980s with the deployment of additional and more advanced space systems for which adequate nonspace alternatives will not be available.

174. The Soviets are undoubtedly aware of the US commitment to develop a nonnuclear orbital interceptor, and they are probably concerned with potential foreign development of ground-based systems for satellite destruction (such as lasers) and electronic warfare. Information is sparse on the vulnerability of Soviet space systems to various forms of foreign interference. We have no information that indicates the Soviets have a program to harden or otherwise improve the survivability of their spacecraft. However, certain features of Soviet space systems tend to offer them some inherent degree of protection:

- For various technological reasons, the Soviet Union has produced spacecraft that have thick skins and are pressurized with a controlled internal environment. This is in contrast to US systems, which are generally thin skinned and designed to work in the vacuum of the space environment. The Soviet practice of using thick skins results in a degree of protection that US space systems do not have, particularly against laser and nuclear radiation and electromagnetic pulse effects.
- The Soviets, having some 70 to 100 active military-related support satellites in orbit at any one time, plus the demonstrated ability to launch replacement satellites quickly, make effective foreign ASAT efforts difficult. The Soviets' greatly increasing use of the geostationary orbit also compounds the problems in designing ASAT systems against them.
- The Soviets' high-resolution photoreconnaissance satellites, ELINT and radar ocean reconnaissance satellites, Salyut space stations, Molniya communications satellites, launch detection satellites, and all their spacecraft in geostationary orbit have a maneuvering capability. This capability can be used to make corrections for drag effects of the atmosphere, to change the orbit for operational reasons, to deorbit the satellite, or to attempt to evade an ASAT weapon.

Prospects for Soviet Spaceborne ASAT Operational Use

175. We know of no instance where the USSR has intentionally interfered with a US space system. Soviet attitudes toward noninterference with US space systems result from an amalgam of political and other factors. Most important among them has been the impact that interference would have on Soviet-US relations. The USSR has explicitly recognized that physical interference with US national technical means being used to monitor the SALT agreements would be inconsistent with its obligation under these agreements. It has not made a commitment to extend this protection to all US satellites or satellite missions. Nevertheless, the Soviets undoubtedly perceive that an attack on any US satellite would contribute in a major way to a deterioration in US Soviet relations.

176. Perhaps the most important of the other factors is the USSR's own dependence on space systems for a variety of military support functions, and its probable concern about potential US retaliation against Soviet satellites or retaliation in some other form. The Soviets presumably would expect any current US response to include something other than a physical attack by a nonnuclear interceptor since they know the United States does not now have that capability. They would also have to consider the level of US dependence on space systems for military support functions, the US ability to respond to a Soviet ASAT attack, and the likelihood of such a response. Each of these considerations is dynamic and will acquire different significance over time.

177. We know very little of the Soviets' operational doctrine for use of spaceborne ASAT systems. We do know that their current orbital interceptor uses ground-based facilities—target-tracking radars, launch pads, and control sites—that are not hardened against nuclear detonations, indicating an intention to employ the system before nuclear strikes on the USSR.

178. Considering all of the above factors, we believe it highly unlikely that the Soviets will use spaceborne means to interfere with US satellites in peacetime, crises, or conflicts not involving direct engagements between US and Soviet forces. We believe the likelihood of Soviet interference would increase but would remain low even if US and Soviet forces were involved but not directly engaged in a limited conflict outside of Europe. In a conflict between US-Soviet forces, the likelihood of Soviet destruction of US satellites using spaceborne means would rise as the conflict escalated. The likelihood of such interference would probably be moderate as long as the Soviets' objectives in a US-Soviet conflict were limited and they believed they could limit the scope and intensity of the fighting. We believe there is a high likelihood that the Soviets would use spaceborne ASAT systems in a NATO–Warsaw Pact armed conflict. The likelihood of such use would be very high if the Soviets perceived that general nuclear war was imminent.

ANNEX A

Soviet Information Denial Techniques

ANNEX B

Major Gaps in Our Knowledge of the Soviet Space Program

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